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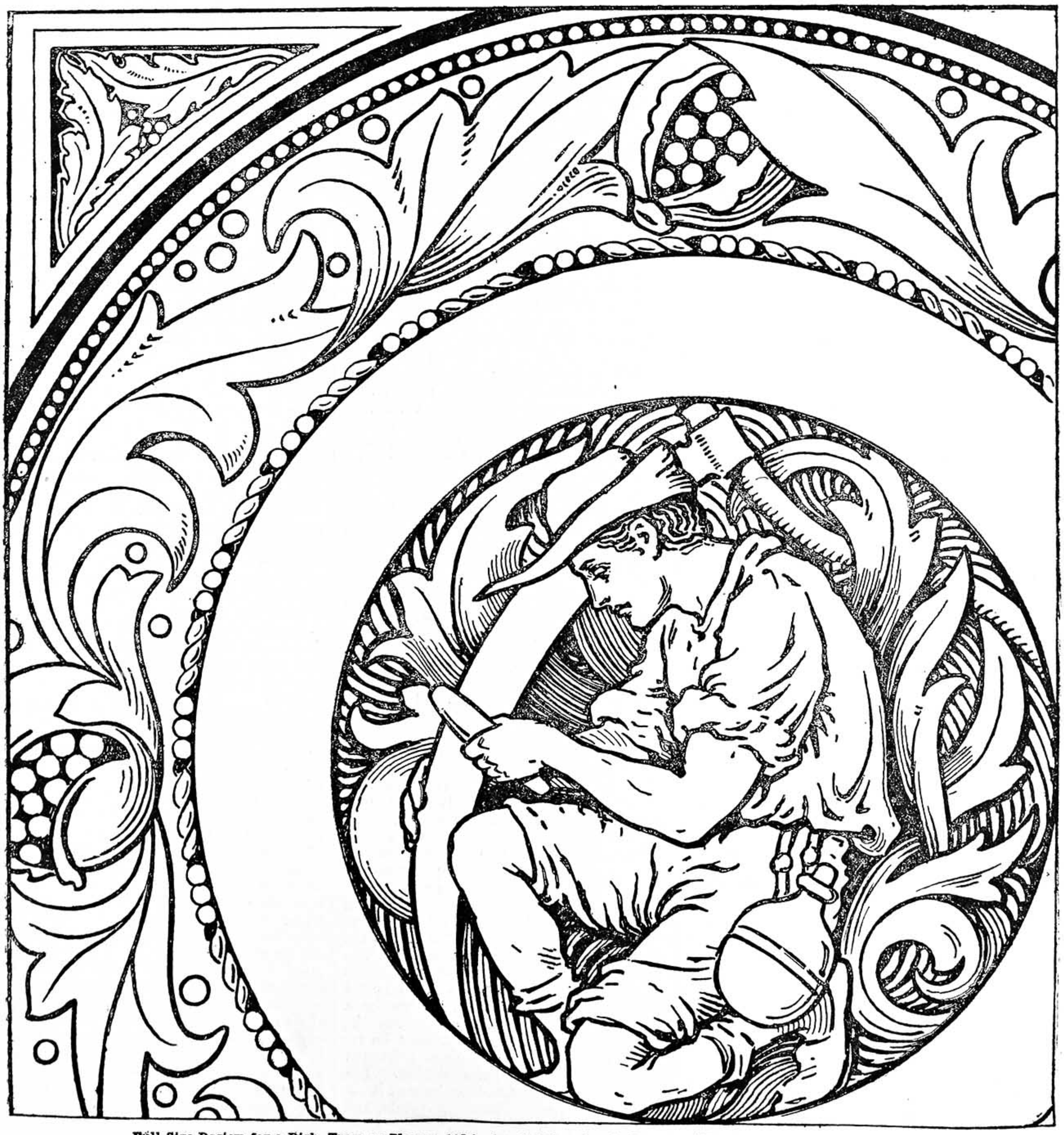
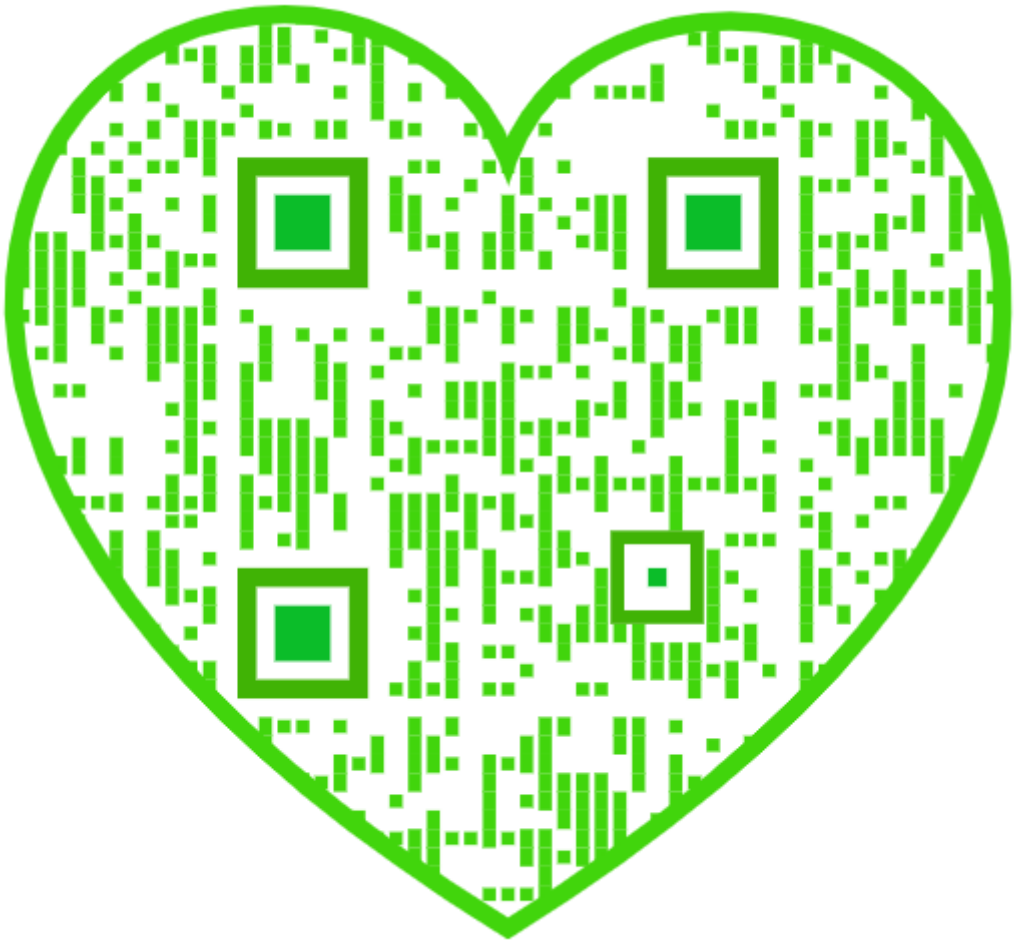


Full-Size Design for a Dish, Tray, or Plaque, 10¾ inches in Diameter, in Repoussé Work, or Panel in Wood Carving.



A FULL-SIZE DESIGN FOR DISH, ETC., IN REPOUSSÉ WORK.

BY J. EADIE-REID, GUILD OF HANDICRAFT.

THE art of beating up metals—such as silver, brass, and copper—is perhaps one of the most beautiful of our handicrafts, and it is with pleasure we see a demand rising in our English market for this work. It is capable of the most varied of treatments—delicate as only the artist hand knows how, yet simple and broad as the most daring.

The technique of repoussé work has been described in Vol. I., so that it only remains for me to touch but lightly upon this side of the subject. Having already made a careful drawing of the design with which you are to ornament your plate, it would be desirable to pounce your sketch, and by this means transfer its lines to your sheet of copper. At this stage go over your lines carefully with Brunswick black or ink. This will enable you to handle your work fearlessly, and will lessen the danger of lost lines and temper. Then begin to chase the outline, taking care not to cut your metal in this fashion, V, but rather make an indentation thus: ᴗ. This, if rightly executed, will have marked your design firmly upon the reverse of the plate. Putting it upon its face, you can beat from the back until you have raised it sufficiently on the front to enable you to model with freedom. Having got your ornament into an advanced state, you must proceed to hammer the plate into its concave shape before finishing. This is done by laying it upon a bed of pitch, and beating steadily with the hammer.

The degree of delicacy of both labour and design can only be determined by the metal which you have under your hand. The design which I have made for you would be suitable for copper, while for work of a more dainty finish silver would be preferable. An hour spent amongst the beautiful examples of repoussé work in the South Kensington Museum will be of more use to you than any words of mine on the subject.

As to design: let it be vigorous, and tell its purpose in as few lines as possible, and above all things—be it plate or sconce, whatever you may have set your heart upon beautifying—do not let your ornament cry out at you, and thrust itself forward; let it rather accentuate the principal lines, give richness to the spaces, and always be decorous.

THE KALLITYPE PHOTOGRAPHIC PRINTING PROCESS.

BY L. IVOR POOLE.

CLAIMS — SIMPLICITY — ECONOMY — RAPIDITY — APPEARANCE OF PRINT—MARGIN—STAINING FINGERS — DRYNESS — OVER- AND UNDER-EXPOSURE—PRINTS FROM THIN NEGATIVES—BROWN COLOUR—CHEMICAL ACTION.

ONE of the simplest photographic printing processes is that which forms the subject of the present article. Simplicity, however, in any new process is not in itself sufficient to entitle it to adoption, for no one should grudge a little extra work to ensure better results by some other means. Although comparatively new, the kallitype process has been introduced sufficiently long to enable one to judge of its qualities. There are few of us who care to take more trouble than necessary to ensure good results, either in our pursuits of matters of business or as pastime, so that when a really good process is brought forward we cannot do less than welcome it. For some time past I have been trying kallitypy, and think, perhaps, my experience may be of use to some of our readers by calling their attention to the process. As stated above, it is simple; it is also cheap and quick—not so rapid as bromide, but more so than the ordinary albumenised paper. I will take up these qualities in the order stated.

Simplicity.—The printing is done in an ordinary frame in the usual manner, by daylight, for the paper is not sensitive enough to be used with artificial light, like bromide. The print, which only becomes faintly visible by exposure, must next be developed; and this can be done after any interval, if they are kept dry in the dark. The development is effected by floating them face downwards for a few seconds in a solution formed as follows:—Nitrate of silver, 50 grains; citrate of soda, 1 oz.; bichromate of potash, 1 grain; water, 10 ozs.; ammonia ·880, ½ dram. This solution is used cold, so that the necessity of keeping it to a certain temperature, as in the older platinotype process, is obviated. The print rapidly develops—as stated above, in a few seconds—and is then placed face upwards on a clean piece of glass, a plate, or anything of the kind, for a minute or two, during which the print gains in brilliancy. A washing solution of the following is then used:—Kallitype developer, ½ oz.; citrate of soda, 2 ozs.; water, 20 ozs. In this the print is immersed for, say, twenty minutes, for considerable latitude is allowable, and then removed to another washing solution made of citrate of soda, 1 dram; ammonia ·880, 2 drams; water, 1 quart. This should be divided in two portions to form two separate baths, the final one of which should be renewed as soon as it assumes the slightest tinge of yellow, when it may be used as the first one of this washing solution, or be added to it. The third washing bath is for the purpose of thoroughly completing the chemical process undergone during development. The print, after being in this solution for twenty minutes, or, say, ten minutes in each bath, is finally washed in clean water for a few minutes, after which it only requires to be dried.

Cheapness.—The expense is inconsiderable, either for the paper or the chemicals. The former can be had cut to the usual sizes or in the full sheet, measuring 26 in. by 20 in., costing from 9d. to 10d. per sheet, according to the number purchased. Cut, the paper ranges in price from 9d. for full quarter-plate size, to 2s. 6d. for whole plate per two dozen package. For purposes where cost is of more consequence than quality, a cheaper paper is supplied at 12s. per quire of full-sized sheets. This make is recommended when large numbers, as for advertising purposes by manufacturers, are wanted; and I have seen some really excellent work done with it, though it is not to be compared with the better quality for ordinary photographs. The chemicals are both inexpensive in the first cost and economical in use, sufficient of the salts to make 10 ozs. of developer being purchasable for 1s. 3d., while the cost of the washing solutions is merely nominal. The greatest point of economy, however, lies in the fact that all the solutions can be used over and over again, and will serve for a large number of prints. By degrees the developer gets exhausted, but may be renewed by adding two grains of nitrate of silver for every ounce of the solution. The first washing bath is usable so long as it removes the yellowness from the prints, and the others should be fully charged with ammonia, and are efficacious, as has been stated, till the final one becomes tinged with yellow. It will thus be seen that there is no toning bath required, so that the costly material known as chloride of gold is dispensed with.

Rapidity. — Although printing is more rapid than ordinary sensitised albumenised paper, I must confess that I do not find it so rapid as it is sometimes said to be. Whether, scientifically, six times the rapidity of ordinary albumenised paper, as it is stated to be, I am not able to say; but, so far as my experience goes, the degree of extra rapidity seems to increase in ratio according to the light. That is to say, the speed, comparing it with albumenised paper, is not so great in a dull light as in bright sunshine. In a poor light the extra sensitiveness of the paper is by no means so marked.

The chief point in respect of speed is the short time in which a print can be completed, for it is quite possible to develop, wash, and dry a perfect one in three-quarters of an hour; while if only a rough proof is wanted, it can be ready in very considerably less, as the time occupied in washing may be reduced to a few minutes.

Appearance.—The prints are a fine black, very much resembling those produced by the bromide or platinotype processes; and, provided the right exposure be given, which is very easily learned, it is almost impossible to fail—provided, of course, that due care is taken with cleanliness and purity of chemicals. The surface is a matt one—*i.e.*, the prints are not glossy.

By using masks, a white margin may be left round any photograph, which can be written on easily as ordinary writing-paper, thus affording a ready means of writing titles, etc., on them. It may further be noted that the prints do not curl, but dry flat; so that by having them with a white margin, mounting may in many cases be dispensed with.

As against the manifold advantages connected with the kallitype process, is the fact that in working it the developing solution is apt to stain the fingers to such an extent as to remind one of the days of wet-plate photography. To avoid this, indiarubber finger-stalls or a pair of pliers, or something convenient, should be used to lift prints in and out of the developing solution. Without some such appliance, it is almost impossible to prevent the finger-nails being stained.

The paper should be kept dry both before and during exposure, as well as during any interval prior to development; otherwise it is difficult to determine whether the exposure is correct, and impossible to get a good colour. I have not, however, found that the paper is particularly susceptible to damp, so that no extraordinary precautions, such as keeping it in calcium tubes, are necessary. If it should be damp, it may be dried by the fire before exposure; but this should be done carefully, as if the paper is made too hot, the subsequent print may be "fogged." Over-exposure should be carefully guarded against, as it is impossible to counteract ill-effects from this cause, the resulting print being "mealy" in appearance or muddy-looking, and very apt to show stains and markings. Under-exposure may, to some extent, be overcome by prolonged development. The best results are naturally got from good negatives; but if these are thin, the prints may be remarkably improved by the addition of bichromate

of potash to the developer. A very small quantity only is necessary.

It is not necessary to develop, etc., in the "dark" room, but certainly the operations should not be done in bright daylight, more care, if anything, being required than with albumenised paper.

Should the print be of a sepia or brown colour, instead of black, it is probably owing to an impure citrate of soda having been used; but if there should be any difficulty in obtaining it, a suitable quality can be had from the manufacturers of kallitype paper.

A not unimportant matter in connection with prints made by this process is that they are considered permanent.

Such, in the main, are the chief features of kallitype and its working; but perhaps a few remarks on the chemical changes on which it is based may not be uninteresting; and for these particulars I am indebted to the courtesy of Mr. Lewis, the founder of the Birmingham Photographic Company, Limited, who manufacture the paper. The paper is sensitised by ferric oxalate. The action of the light changes this from a ferric to a ferrous salt. During development the processes are somewhat complicated, and may be briefly explained thus. The ferrous oxalate is dissolved by the citrate of soda, which enables it to reduce the nitrate of silver, and prevents the precipitation of iron by the ammonia. This is required to dissolve the citrate of silver which is formed by the nitrate of silver and citrate of soda. On floating the paper on the developer, metallic silver in the form of a black powder, which forms the picture, is precipitated. The bichromate of potash assures contrast, and being a very powerful oxidiser, is used in very minute quantity, for in excess it would dissolve the half tones. The final baths, in which ammonia is the principal chemical agent, fix the prints, and if this is not done thoroughly, it seems hardly necessary to say that discoloration will speedily ensue. With this *résumé* of the chemical actions involved, my remarks must be brought to a close. It may be well to add that the process has been considerably improved on since it was introduced in the early part of last year; and that, bearing in mind the demands on the "Shop" columns, it will be as well for those who meet with difficulties or want further information about kallitype to apply direct to the manufacturers. Their address is 99 and 100, Gladstone Road, Sparkbrook, Birmingham.

THE SAFETY BICYCLE: ITS PRACTICAL CONSTRUCTION, ETC.

BY A. S. P.

FITTING BEARINGS ON BOTTOM BRACKET—FITTING THE CRANKS—TURNING AND FITTING REAR FORK ENDS—TURNING AND FITTING STEERING BARREL AND TUBE—FITTING FRONT FORKS—HANDLE-BAR, ETC.—CENTRE BRACKET—CUTTING THE TUBES TO LENGTH.

WE have now to look up the illustrations accompanying these papers in page 168, in order to find the parts of our machine requiring turning and fitting. Suppose we take the bottom bracket casting (Fig. 4, page 168). We have first of all to get a pair of knuckle-joint ball-bearings, which may be Bown's or Rudge's, or the Birmingham small arms' make, which are the cheapest of the three. The forks in the lower end of the bracket have to be filed out to fit the knuckle-joint. (See Fig. 4 B.) To file them both straight and true with each other, they should be finished with a long flat file, and both at once, to ensure their being true, so that the two bearings will, when fitted, be truly parallel with each other; as, unless they are so, when the axle is inserted it will only run freely in the bearings if they are truly set in line. The knuckle-joint should fit the fork tightly and without shake, as, apart from the unpleasantness of pedalling with loose, shaky bearings, the shaky movement twists the shaft in the bearings at every stroke, and in a very short time destroys them. The bearings neatly fitted, bolt-holes must be bored through the jaws of the fork to carry the bearings. These are usually $\frac{5}{16}$ in., and require to be very accurately bored, in order to meet the hole in the knuckle-joint, which must not be tampered with in any way. As the forward ends of the rear tubes are bolted to the back of this bracket, it is necessary to file the back edges quite true, as also the face of the cross-plate on the end of the rear tube. This plate is also bored with $\frac{5}{16}$ in. holes, for bolting on; the lower end is held by the bolt that holds the bearing, and the upper end by a similar bolt passing through the fork at the semicircular projection.

The two sockets on the top have to be bored or reamed out to fit $1\frac{1}{8}$ in. tube. This done, the whole bracket is filed up neatly; and at this stage the pedal shaft should be fitted.

The pedal shaft is a piece of round $\frac{3}{4}$ in. steel; $7\frac{1}{2}$ in. long over all. It is turned for bearings and cranks, as shown at Fig. 16. The central part, which is $\frac{3}{4}$ in. thick, is $4\frac{1}{4}$ in. long; on this part, as indicated at W, the chain-wheel is keyed on. A good long flat, at least $\frac{3}{8}$ in. broad, is made on the $\frac{3}{4}$ in. part of the shaft, and a key-slot in the boss of the wheel, with a key of steel well fitted. The chain-wheel is to be keyed on the shaft, exactly in line with the cog on the rear wheel hub; and, of course, this cannot be done till that wheel is in its fork. Meantime, fit the two sleeves of the ball-bearings (see Fig. 16) on to the parts marked B, B on the shaft. These sleeves, which should have a $\frac{11}{16}$ in. hole, have each a small flush set-screw, which enters a small hole in the shaft. Of course, these two sleeves must be placed on the shaft, so that when the balls are inserted the cases will hang parallel in the bracket, and the shaft turn freely when the bearings are adjusted. The parts C, C are reduced to $\frac{5}{8}$ in. for the cranks, the boss of which is usually $\frac{3}{4}$ in. through the hole. The cranks should be bored first, and the shaft ends turned to fit. Now, cranks may be keyed on hard and fast, or they may be detachable. Keyed-on cranks are cheapest, but they have a nasty trick of coming loose when not wanted to. They have also a nasty trick of resisting every attempt to get them off when wanted. (For keyed-on cranks, see Fig. 17.) A flat is made on the parts C, C on opposite sides of the shaft; then cranks are slotted, and keys fitted same as for the chain-wheel. In detachable cranks (Fig. 18), a pin with a nut passes edgeway through the boss end of the crank, as shown; the hole bored for the pin cuts a piece out of the shaft. After the hole is bored it is made taper, and a taper pin fitted; this pin is often flat on one side, and a flat filed out of the shaft to fit. When a crank of this sort becomes loose the pin is simply drawn in, and the nut takes and keeps it up; by removing the pin, the crank may be readily taken off; hence its name, "detachable."

If the cranks are bought as rough stampings, they have got to be bored for shaft, slotted or bored for keys, filed out in the long slots for pedal-pins, then finished up and polished for plating.

Now we will lay this bottom bracket aside, to be taken up when the tubes are fitted and brazed.

Fig. 6 (page 168) is the fork end for the rear wheel. The one shown is that for the left side, having the extension for the step. The hole for the step is tapped $\frac{3}{8}$ in. The centre hole for the adjusting screw should be bored and tapped $\frac{5}{16}$ in., and a square-headed pin fitted; this pin is 2 in. long. Now the tenons A and B are turned: A to fit inside $\frac{3}{4}$ in. tube, and B inside $\frac{5}{8}$ in. tube. The shoulders should be cut square in, so as to ensure a good joint when the tube is fitted. These parts may now be laid aside, as they will require to be filed up after brazing, and the screw-holes cleaned out with the taps.

Fig. 7 (page 168) is one form of step which is commonly used. A rubber step would simply have a $\frac{3}{8}$ in. pin about 2 in. long, and a foot-rest rubber put over it with a $\frac{3}{8}$ in. nut on the end.

We now take the steering barrel (Fig. 8, page 168) in hand, with the front fork crown. The two ends of the barrel have got to be coned out in the lathe. For this purpose it is mounted on a mandrel, like Fig. 19. The ends of the mandrel are reduced to $\frac{5}{8}$ in., to allow a side-cutting tool to work in making the coned parts. The cones are made to an angle of about 60°. This done, the outside of the barrel is turned on the same mandrel, all but the parts where the projecting sockets interfere. Opposite these the file must be used. The two sockets are now cleaned out to fit $\frac{1}{8}$ in. and $\frac{5}{8}$ in. tubes respectively. Then the inside of the barrel is reamed or bored out, to allow the 1 in. tube to pass up easily. This 1 in. tube, called the "steering tube," has got to be fitted to the top of the fork crown, A (Fig. 8); and from the abutting shoulder of the tube the coned part falls away, as shown. This is of the same angle as that in the barrel, so that the one will fit neatly on the other. The crown piece may have a $\frac{5}{8}$ in. hole bored through its centre to lighten it, or a $\frac{3}{8}$ in. hole may be bored and tapped for a screw to fix the mud-guard. This hole must be bored and tapped before the forks are brazed on. These may now be fitted to the two tenons, B, B (Fig. 8), on the crown piece. These should be fitted without shake, and to fill the forks all round, else they will not be good brazing joints. The forks have to be pinned on with $\frac{3}{16}$ in. wire pins, or screws of the same thickness, which are sold for the purpose. But before pinning them on, the lower ends of the forks should be prepared for the front wheel axle, or pin. First of all, the two forks should be made exactly one length, and that length to allow 1 in. clear between the rubber tire and the fork crown, as this is the space required for the brake-spoon. A common practice with hollow-front fork ends is to squeeze them, shut in a vice, and bore the hole for the shaft through the two thicknesses. This is a slipshod method, though it is done by good makers. A better plan is to have solid ends, as Fig. 20, brazed into the fork ends. These are $\frac{1}{4}$ in. thick, and the holes for the screwed parts of the shaft are $\frac{1}{2}$ in. These two solid pieces when brazed into the forks have to get a little set inwards, to be parallel with each other where they abut on the hub ends. The fork ends should be nicely filed up after brazing, and the axle holes bored before they are pinned on to the crown piece.

Returning to the steering tube, which is 11 in. by 1 in. outside diameter, we have to fit a ring or collar, C, coned to fit the upper part of the barrel. This ring is $\frac{1}{4}$ in. thick, and stands $\frac{1}{8}$ in. above the end of the barrel. A small flush set-screw is put in for adjustment, which presses against the side of the tube, without any perforation to receive the point, which should be blunted or flattened off. On the upper end of the steering tube the lamp-bracket collar is fitted and brazed. This serves a double purpose, as it has the binding screw behind and the lamp bracket in front. The adjusting screw in this is $\frac{7}{16}$ in., tapped. The handle-bar tube, a part of which is shown in the figure, is 8 in. long, and should pass freely inside the inch tube, though without shake. Inside this $\frac{1}{8}$ in. extension tube a piece of $\frac{3}{4}$ in. tube should be driven, so that the two thicknesses may the better resist the pressure of the set-screw. Sometimes the extension piece is made solid for this reason. The handle-bar T-piece is a stamping or casting (see Fig. 21), with a hole bored horizontally to admit a $\frac{3}{4}$ in. handle-bar. The tenon A is turned to fit inside the $\frac{3}{4}$ in. extension tube. This tenon is about 1 in. long. It takes 32 inches of $\frac{3}{4}$ in. tube to make a handle-bar. They are now made of many forms and twists, some of them remarkable only for their ugliness. I usually make the handle-bar as in Fig. 22, with a rather sharp turn at B, B, 8 in. from the ends. The horn handles take up 4 in. of this. The T-piece must be fitted on before the second bend is made, as it cannot be put on afterwards. After making one bend, draw it on a board with pencil, and make the second bend to fit the drawing. The T-piece should, of course, be placed in the centre of the straight part, and it must be set before pinning at an angle to fit the steering tube, as in Fig. 1 (see page 33), where it will be seen that the bar is level to within an inch of the horn handle, when it is bent downwards, allowing a more natural grip of the handles. In plan, however, the bar looks as if straight after leaving the bends, as in Fig. 22. The handle-bar, with its extension piece, should be finished up and polished for plating before the horn handles are put on. If the lamp-bracket collar, above referred to, is neatly fitted to the tube, and two small flush screws, one on each side, inserted to bind it to the tube, the brazing may be dispensed with, and the bracket can then be plated, which adds considerably to the appearance of the machine. The adjusting collar, C, is also plated.

We now turn our attention to what may be called the centre-frame bracket (Figs. 9 A, 9 B, page 168). To this part we have no less than four tubes attached, as well as the L-pin and its binding screw. The part containing the L-pin is vertical, the L-pin hole $\frac{5}{8}$ in. and the metal surrounding it $\frac{3}{16}$ in. The upper projection is the socket for the upper tube of the frame that runs forward to the steering head. The lower projection is simply a solid part, through which a $\frac{3}{8}$ in. hole is bored, and tapped $\frac{7}{16}$ in. for a set-pin to bind the L-pin. The part of the bracket drooping away from the L-pin socket has the eye or socket for the bent tube $1\frac{1}{8}$ in. diameter. On the sides of this are the two long sockets for the rear tubes, $\frac{3}{4}$ in. diameter. (See Fig. 9 B.) S S is a full-size section of the central part of the bracket. This is a part of the machine that cannot be bought of any of the makers or dealers in this form; consequently, a pattern has got to be made, from which any number may be cast in malleable steel—or cast steel, as it is called. For the benefit of those who would prefer to buy all the parts without troubling about pattern making, I here show (Fig. 23) a bracket for this part of a diamond frame. This is used by several makers in lieu of Fig. 9. It is bought in the rough, and the tenons turned to fit the frame tubes. The two rear tubes join on to it by a bolt passing through an eye on the end of each tube, and through a corresponding lug on the rear of the bracket. (See A, Fig. 23.)

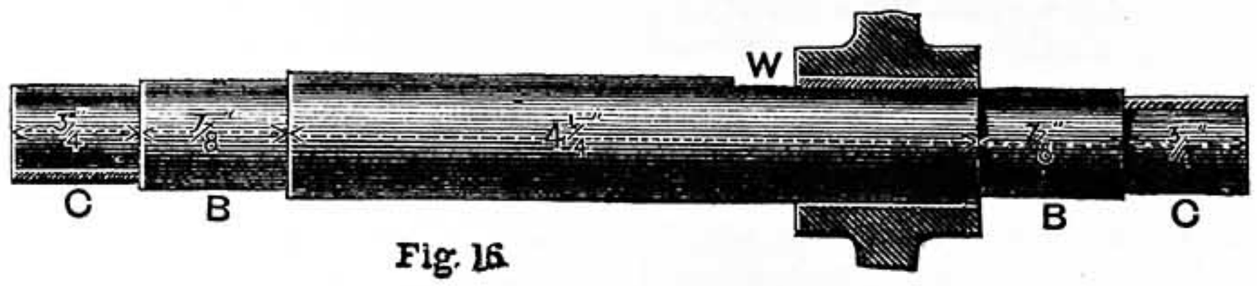


Fig. 16.

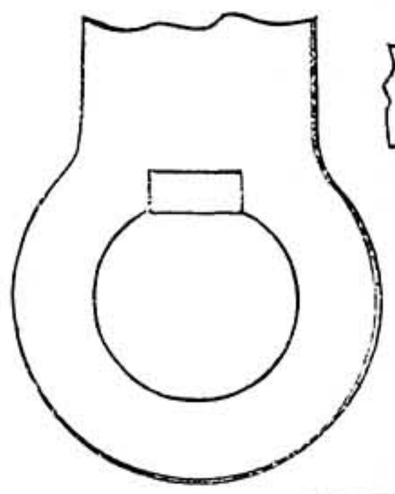


Fig. 17.

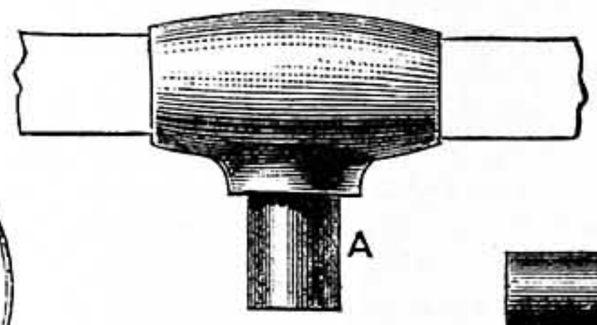


Fig. 21.

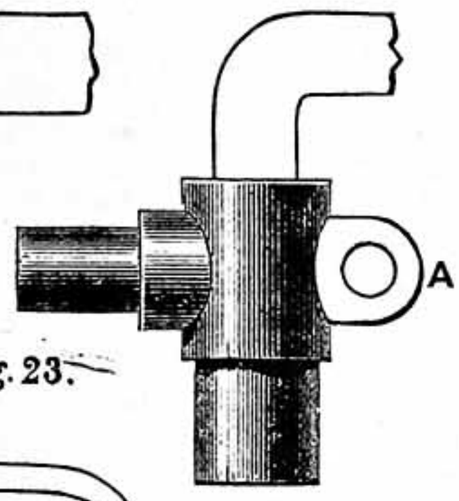


Fig. 23.

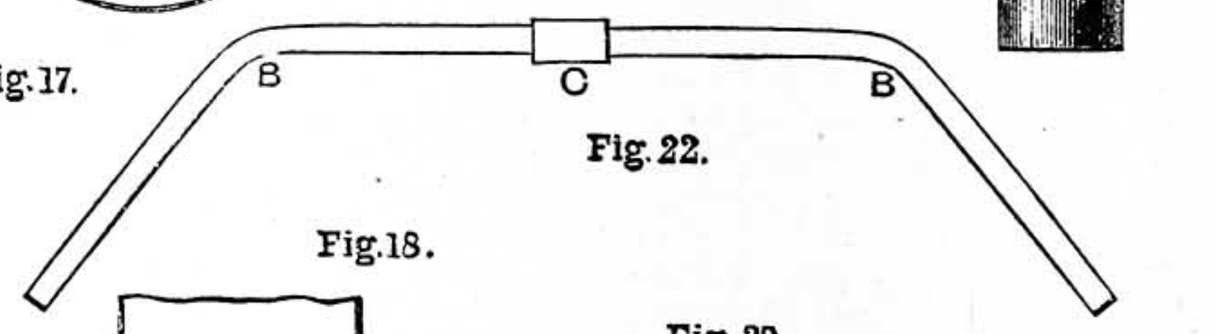


Fig. 22.

Fig. 18.

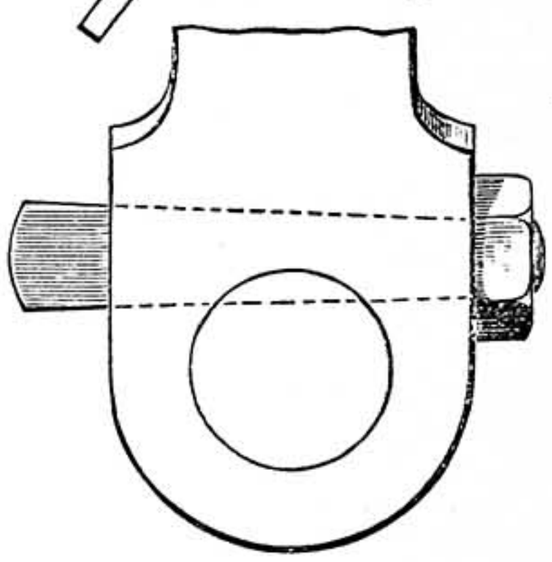


Fig. 20.

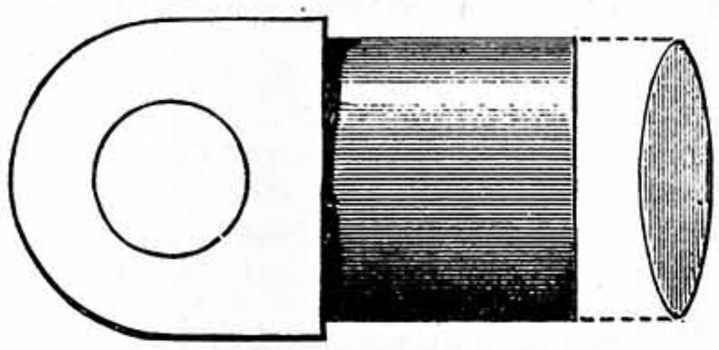


Fig. 19.

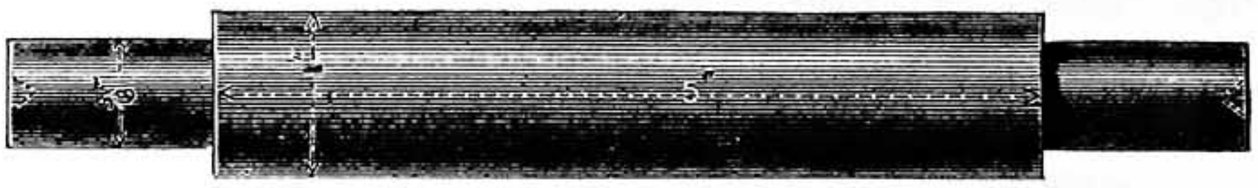


Fig. 16.—Pedal Shaft (half size)—W, Chain-wheel Boss. Fig. 17.—Crank keyed on (full size). Fig. 18.—Crank with Collar and Nut (full size). Fig. 19.—Mandrel (half size). Fig. 20.—Stamping for Fork End (full size). Fig. 21.—Handle-Bar T-Piece (half size). Fig. 22.—Handle-Bar ($\frac{1}{8}$ full size). Fig. 23.—Bracket for Ordinary Diamond Frame (half size).

With regard to the bottom bracket above described (Figs. 4A, 4B, page 168), the same objection to pattern-making may obtain. There are quite a lot of styles of bottom ball bracket in the market, from which our cycle-maker may choose, if he refuses to face pattern making. Being a pattern maker, the thing offers no difficulty to me, and I show in these papers my own designs of certain parts, which, of course, have got to be made from patterns not being in the regular market. The fork-bottom bracket, as shown, is my own; and I am satisfied that while it may not be the best, it is much better than many in the market.

Several of the dealers in cycle material issue elaborate catalogues, in which most of the parts are illustrated, and from which the buyer sees what will suit him, there being generally a variety of patterns of the same thing. I should, however, advise our cycle maker, if he is anything of a mechanic, to make all he can make, else he will hardly be able to say he made his machine.

I have now gone over most of the parts of the frame, except tubes and brake work.

The parts here treated being finished and placed in position upon the full-size drawing, the exact length of all of the tubes will be readily measured. The tubes, being cut to the proper length, are to be filed dead square on the ends: this is done with the tube caught upright in the vice. A small engineer's square is used to the ends when filing. The square is applied at three or four different places round the sides of the tube, with the blade across the end. In this way all the tube ends are treated that abut on a shoulder on the solid connections. Those, however, that enter sockets need not be squared on the ends. All tubes that are to be brazed into socket should have an inch or so on the *outside* cleaned with a file; likewise all tubes that have tenon pieces entering them, such as those squared on the ends, should have an inch or so of the *inside* filed clean. This is done that the brazing metal may take proper hold. These connections, moreover, should be kept quite free from dirt or grease. All brazing joints have got to be pinned—that is, small holes must be drilled through all junctions of tubes and solids. If plain wire pins are used, it is best for them to pass quite through both sides, and rivet at the ends, as a plain pin through one side only is apt to drop out while in the fire. Most makers use small $\frac{3}{16}$ in. screws for holding the parts, called "brazing screws." Being screwed in, they do not drop out. The object of this pinning or screwing is to prevent the parts of the frame moving in their sockets while in the fire; as, though they may be tightly fitted, they soon get loose under the heat, and, having been set

true to square before pinning, it is very desirable that they should remain so.

I fear I have given many of my readers trouble by referring them to diagrams that have appeared in preceding chapters. I am sorry to have done this, but it will, I think, be perfectly clear to them that it is a case of necessity. The repetition of figures already given could not be expected, as the adoption of such a course would involve the sacrifice of much valuable space, and, in consequence, there was nothing left for me to do but give references, so that the diagrams may, at least, be easily found.

The "Loop" or "Bend" Shortening (Fig. 55) is the simplest of these. The rope is merely bent as much as is required, so as to form two bights, and the two parts seized together with small stuff. This is a simple and good method of shortening ropes.

The "Chain Knot" (Fig. 56) is another method of shortening ropes. In commencing it, we make a running knot (Fig. 57), and then draw a portion of the part A through the loop B; this is done with the forefinger and thumb of the left hand. It will now form another loop, through which a fresh piece of A is to be passed. This process is to be repeated until all the slack of the rope is taken up. There are two ways of finishing it off: either by putting a piece of stick or belaying-pin through the last loop, or by drawing the end itself up through the bight.

The "Twist Knot" (Fig. 58) forms another handsome shortening. In commencing, we place the cord to be shortened as in Fig. 59. One of the outside parts is then brought over the middle strand, and the outer strand on the opposite is brought over this, which is now the middle part. This is continued as long as required, the outside strand alternately being placed over the centre strand, as in an ordinary three-plait. Fig. 58 shows the plait completed, and the way of finishing off the end. These shortenings are ornamental as well as useful. Among other purposes, they may be used for thickening a piece of small cord, so as to give more substance where it has to be hauled upon, and thus prevent the hand being cut with the cord.

Fig. 60 is the "Sheepshanks" or "Dog-shanks"—a very old-fashioned method of shortening, and one that is a good deal used, as it is applicable to any size of cordage. The twist and chain knots are not suitable

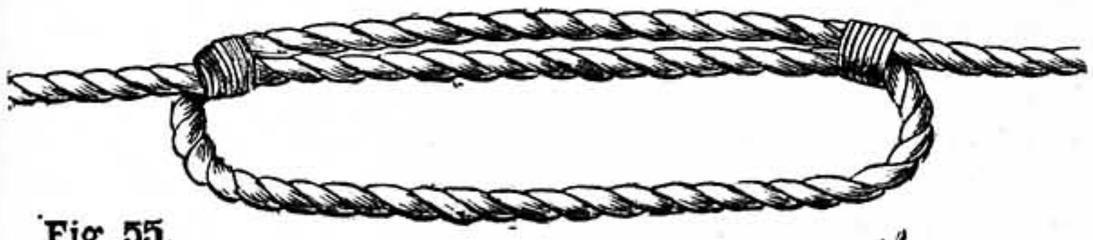


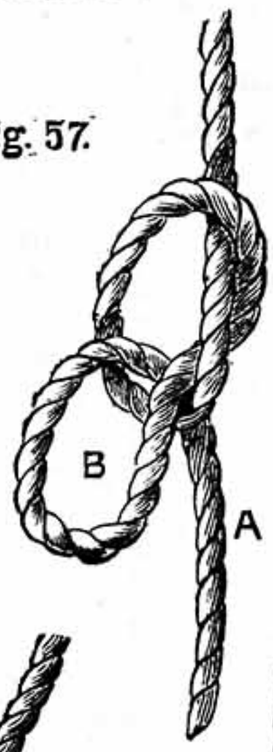
Fig. 55.

Fig. 61.

Fig. 56.

Fig. 58.

Fig. 57.



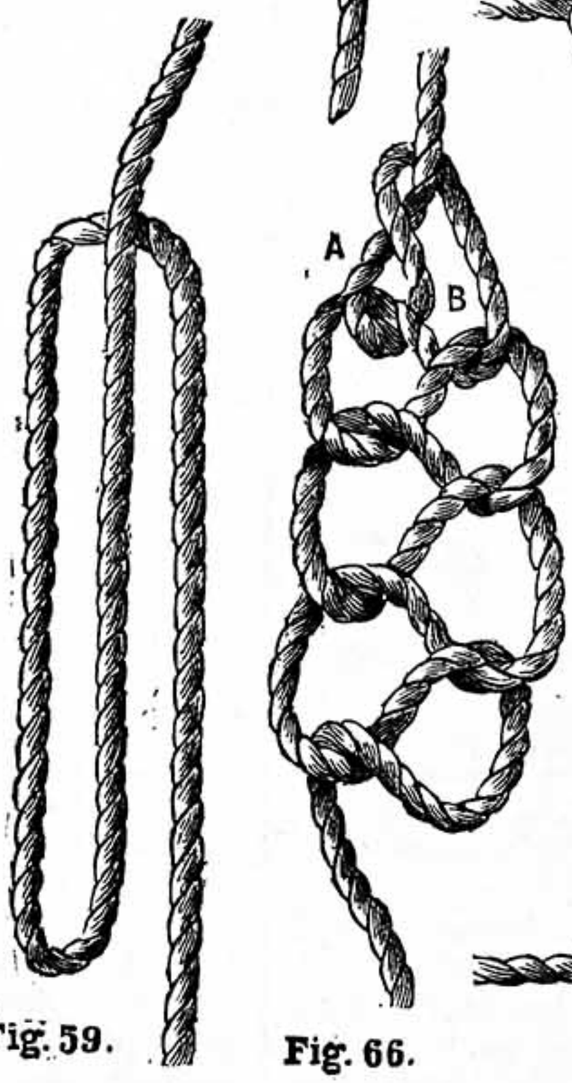


Fig. 59.

Fig. 66.

Fig. 60.

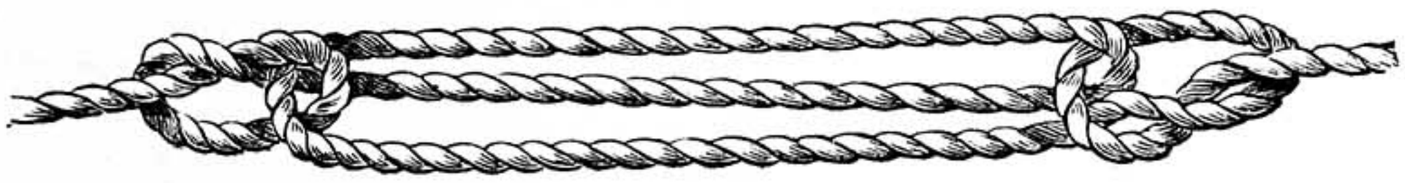


Fig. 62.

Fig. 63.

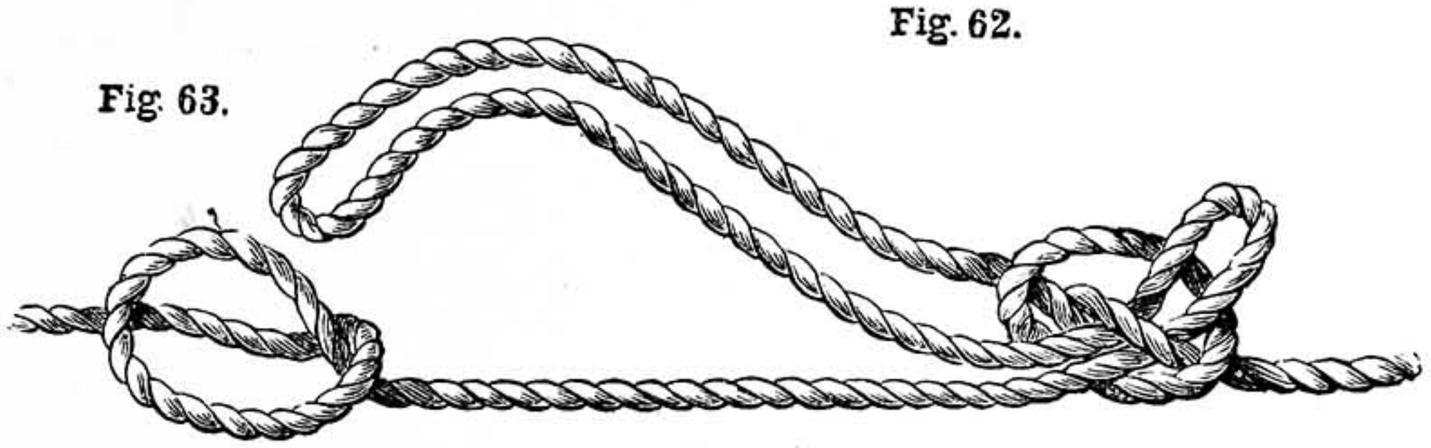


Fig. 65.

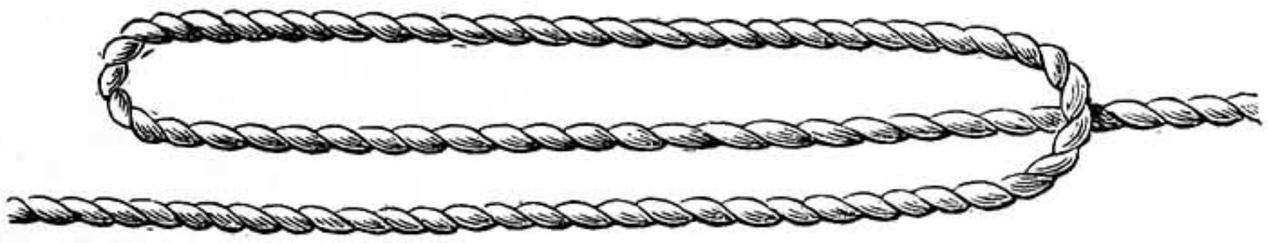


Fig. 67.

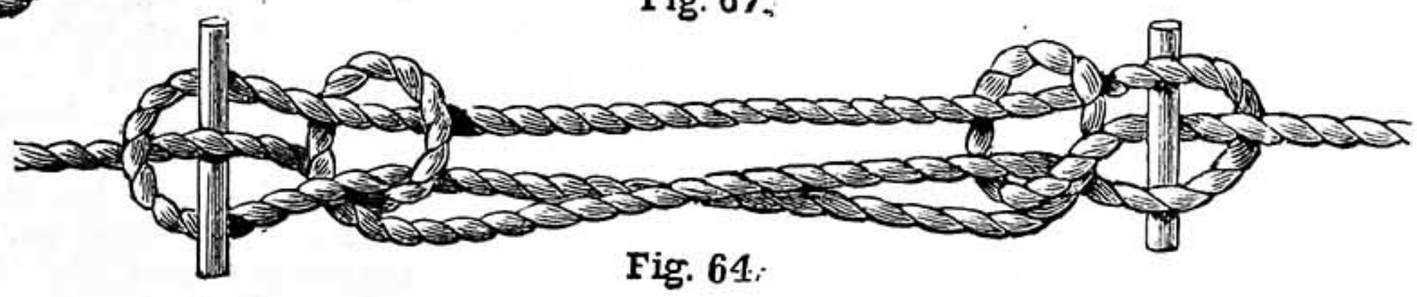


Fig. 64.

Fig. 55.—Bend Shortening. Fig. 56.—Chain Knot. Fig. 57.—Commencement of Chain Knot. Fig. 58.—Twist Knot. Fig. 59.—Commencement of Twist Knot. Fig. 60.—Sheepshanks. Fig. 61.—Sheepshanks fastened. Figs. 62 and 63.—Sheepshanks knotted. Fig. 64.—Boat-Knot Shortening, or Sheepshanks toggled. Fig. 65.—Knot Shortening. Fig. 66.—Double Chain Knot. Fig. 67.—Double Chain Knot connected.

KNOTTING, SPLICING, AND WORKING CORDAGE.

BY LANCELOT L. HASLOPE.

SHORTENINGS.

BEND FASTENING—CHAIN KNOT—TWIST KNOT—SHEEPSHANKS—SHEEPSHANKS FASTENED, KNOTTED, AND TOGGLED—KNOT SHORTENING—DOUBLE CHAIN KNOT.

IT frequently occurs that a rope is too long for the purpose for which it is required, and as it would be inadvisable and wasteful to cut it, some method of reducing its length had to be devised; hence arose what are termed "Shortenings."

for very stout rope. Two bights are formed in the rope, as in Fig. 59; a half hitch is then made at each end, and slipped over the bights. This is made more secure if a seizing is put round the two parts, at A and B. It can also be secured when ends of rope are free by passing each end through adjoining bight, as shown in Fig. 61.

Fig. 62 is a "Knotted Sheepshanks." This is very similar to the last, the only difference being that the ends are fastened in a rather different way. The two bights are made as before, and each end, after passing through the bight nearest to it, is put through the bight it has just made, thus forming an overhand knot at each end.

In making Fig. 63, the parts of the rope are arranged as before. A marlinespike hitch is made at each end, and the bight put through it. The left side of the figure shows the knot made, and the bight in the act of being passed through it. It goes over the outside strand, under the centre one, and over the next. On the right side of the drawing the loop is shown in its place, ready to be hauled taut.

The "Boat-Knot" Shortening (Fig. 64) is another form of Sheepshanks. In this the ends are secured by bringing a portion of the loose part of the rope through the bight at each end, and toggling it with a belaying-pin or piece of wood, as in the Boat Knot. This has the advantage of being loosened very readily. This can be made when both ends of the rope are fast.

The "Knot" Shortening (Fig. 65) is a ready mode of taking up the slack of a rope, though it is not suitable for very stout ropes. It can only be made, however, where one end of the rope is at liberty. The rope is laid as at Fig. 67. The three parts are then grasped with both hands near the bights, and an overhand knot is formed with the whole of the strands. It forms a good shortening for moderate-sized cordage, where the strain is not too heavy.

The "Double Chain Knot" (Fig. 66) is perhaps the most ornamental knot of this group. A turn is first taken round the standing part, and the loose end is then passed through the loop thus formed at A. In doing this another loop (B) is made, through which the end is brought. The end is thus continually passed from one side to the other through the preceding loop until the knot is of the proper length. It may be finished, if required, by making an overhand knot with the end over its own part, or merely passing it through the last loop, and hauling on it.

THE MAINTENANCE OF A TRUE HORIZONTAL AND LATERAL POSITION IN DRAWERS WHEN PULLED OUT TO THE FULLEST EXTENT.

BY THE INVENTOR.

DROPPING OF DRAWERS WHEN DRAWN OUT—MODE OF PREVENTING THIS—NATURE OF INVENTION—FLAPS—HOW AND WHERE FIXED—ADVANTAGES OF INVENTION—CASES IN WHICH INVENTION IS SPECIALLY APPLICABLE.

IT is well known that drawers, however well made, are very liable to, and usually do, stick when being pushed in, unless during such operation they are held in a true position. For instance, when drawers, as at present constructed, are drawn out more than half way, they invariably *drop*, so that to enable such drawers to be easily pushed in (when out for more than the distance referred to) it becomes necessary to raise the drawers at the time of pushing them. It is also necessary to apply the pushing force centrally. For instance, in drawers as at present constructed, should they be provided with two handles, they often stick if only one handle be used.

The inventor claims that a drawer, when constructed with the following simple improvements (for which a patent has been applied for), may be drawn so fully out that the *back* of the drawer may be flush with the front of the cabinet, and that drawers when so drawn out can be moved in again with the greatest ease, however carelessly pushed. Nor is it necessary that care should be observed in the pulling out of the drawers, as a stop should be fixed to prevent their being pulled out altogether.

The invention consists in fixing to the back of each drawer hinged flaps, which open as the drawer is pulled out. For ordinary drawers three flaps are used: two (one at each side) which when open fall downward and keep the drawer laterally true; and a centre flap which opens out like an ordinary door, this flap keeping the drawer horizontally true.

Fig. 1 shows an elevation of the back of a drawer fitted with such flaps closed. The thickness of the flaps may be ½ in., or less; a drawer with ½ in. flaps would be only less by this thickness than the width of the cabinet.

Fig. 2 is a sketch of the flaps when open. The flaps, being prevented by checks from opening to more than an angle of about

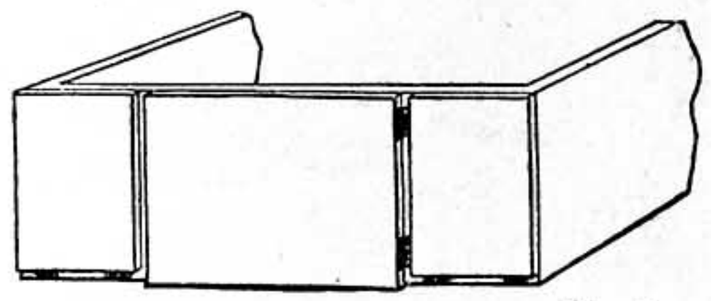


Fig 1.

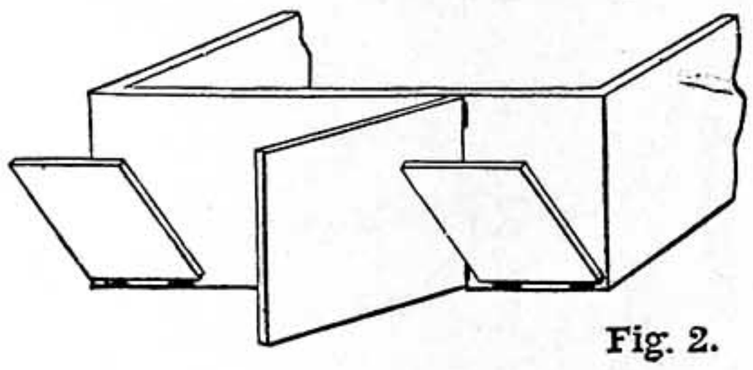


Fig. 2.

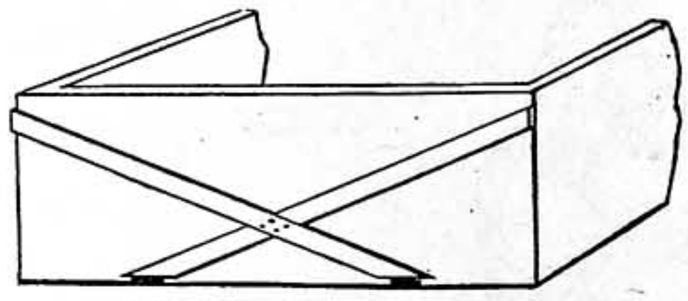


Fig. 3.

Fig. 1.—Back of Drawer fitted with Flaps closed. Fig. 2.—Back of Drawer fitted with Flaps open. Fig. 3.—Substitute for Central Flap. Fig. 4.—Sliding Shelf fitted with Flaps.

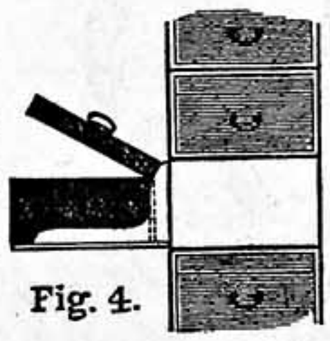


Fig. 4.

45 degrees, will close of themselves as soon as they press against the back of the cabinet, should they not be closed before reaching the back when the drawer is being pushed in. It is suggested that a slight spring be fixed to each flap, to force it outward, though it will be found that even without a spring the flaps, by friction against the sides, do in practice usually open of themselves.

Drawers fitted with such flaps *cannot*, however far they may be out, stick when being pushed in, because the flaps which act as guides touch the sides, and these flaps, when the drawers are being pushed in, coming in contact with the sides, commence closing, and so give the drawer a start to slide easily. The expense of providing such flaps is trifling, as they can be made of deal wood.

The vertical flap, which keeps the drawer from *dropping*, is necessary if it be intended to pull out the drawer more than half way; but where it is not considered necessary to pull it out more than half way, then the vertical flap (the centre one) may be dispensed with, and one flap extending across the back of the drawer, fitting the sides, is all that is necessary. This flap may be simply made with two pieces of wood crossed, as in Fig. 3, which shows this description of flap closed.

The inventor considers, though, that the chief advantages to be derived from the invention (for which object the flap which opens vertically is also used) are, that drawers may, when so fitted, be drawn *fully* out, and may be pushed in again with the greatest ease. No care as to the manner of drawing out or pushing in need be observed, as the drawers will be found to move freely however one-sided or carelessly the necessary force is applied.

It is obvious that drawers which can easily be drawn *fully* out and pushed in again must possess advantages over those which do not permit of this. Drawers, as at present constructed, cannot be pulled fully out, and consequently their whole capacity is often not utilised.

Drawers of small width are at present the most liable ones to stick when being pushed in, and so their utility is impaired. This invention entirely removes the difficulty, and the inventor is of opinion that drawers of small width will now become more used. The invention should be especially applicable to drawers containing heavy weights, such as coin, etc. Sliding shelves may also be fitted with this invention, and shelves so fitted would be especially useful for the reception of deed and other boxes, as the drawers could be pulled out and the boxes opened whilst they were still upon the shelf, as in Fig. 4.

This is the only invention which permits of the drawer or shelf being *fully* drawn out without any supports in front.

PRACTICAL PAPERS FOR SMITHS.

BY J. H.

FORMATION OF RINGS—PUCKERING OF METAL DUE TO BENDING—BENDING BLOCKS—BLOCK FOR BENDING FLAT BARS—BLOCK FITTED WITH SCREW FOR GENERAL WORK—DETAILS OF RING FORMATION—WELDING ENDS—APPLIANCE FOR LIFTING HEAVY RINGS—USEFUL BLOCK FOR MAKING RINGS IN QUANTITY.

IN previous papers in Vols. I. and II. of WORK I have taken a general survey of the various typical operations performed by the smith. The historical and ornamental branches of smiths' work formed the first section; the general practice of modern forging by drawing down, upsetting, welding, and shaping by various tools, with some practical examples, formed the second. In this, the third series, I shall discuss certain of the special operations and branches of this craft, which, though not of necessity distinct from its general practice, can nevertheless be better treated under separate headings. In this way I hope to write on the methods of making holes, on the working of steel, the making of tools, hardening and tempering, model work, repairs, and some other matters of a special character. The present paper will deal with the formation of rings.

Curves and rings of light section are easily bent over the beak of the anvil or around a mandrel of suitable diameter. The case is different when the sections are heavy, and then some kind of appliance is necessary. I shall therefore describe some serviceable bending blocks.

It is easy enough to bend iron flatwise, but not so easy to bend it edgewise. The reason

is apparent if we consider that when a wide bar is bent two things must happen. Along the centre of the bar (Fig. 1, A A) there will be a portion of metal that is simply bent, without compression or extension of fibre. But on the outside, B B, of this neutral axis there are successive zones of metal that are variously extended, and on the inside, C C, of this axis there are zones of metal that are variously compressed. We know what must happen then. The metal in tension and the metal in compression will seek relief from the intense stresses to which it is subjected by corrugation into planes above and below that of the main body itself. It will become wrinkled and puckered upwards and downwards. This tendency has to be corrected by hammering, or by the use of mechanical devices.

Quite an infinity of devices are resorted to in the smith's shop for the purpose of bending work of various sections and outlines. The making of a cast-iron templet or bending block is a question of relative cost. In some cases, where only a few plain pieces have to be bent, it will not pay to make the simplest block. In others, where there are dozens, scores, sometimes hundreds of pieces, all alike, it pays to cast the most elaborate blocks, and fit them up with clips and cottars, or whatever besides may be necessary. Of course, I cannot show a tithe of the blocks that may be formed. When a smith sees what is wanted in forgings, it is usually easy to design blocks for those forgings.

Fig. 2 shows a very common type of block used for bending flat bars. Made in suitable sections, it is also often employed for bending T-iron. As drawn, the working edge, A, is a regular curve; but other curves could be imparted to it equally well. The block has a stout cottared pin cast in it, projecting from its bottom face. This pin passes through a suitable hole in the levelling block, C, and is cottared beneath. This is, on the whole, the most convenient method of holding cast-iron templet blocks down—better than having movable clips. D, D are clips, by which one end of the bar, E, to be bent is confined in its groove. They are fastened with bolts through some of the holes which are usually cast in profusion in all bending blocks, and the cottar, F, passing through slot holes in D, D, holds the bar, E, fast down in its groove. As the free end of the bar, E, is carried farther round, more clips are brought to bear upon it; otherwise, the bar would rise up from its seating.

Fig. 3 shows a common levelling and bending block, fitted with a screw for general work. Such a block is useful for several purposes. Upon it, bars and plates of metal that have to be made true can be straightened and levelled by hammering. From its face, many forgings in process of formation can be tested by the square, one edge of the square being laid upon the block, and one edge against the vertical face of the work. The bevel can be similarly used. Work can also be taken out of winding upon its surface; and it is used largely for bending iron bars to various curves. The block, A, is pierced with numerous holes of circular, and of slot, shapes, for the purpose of receiving pins of various kinds, which form the necessary points of leverage when bending. There should be no stint of holes, short of unduly weakening the plate. At B there is a screwed block, secured to the plate with a shank or pin through which a cottar way passes. The driving-in of the cottar underneath secures this block in position, and by the interposition or removal of a ring the height of the block can be varied. Through the block the powerful square-threaded screw, C, passes, and is operated by the heavy cross, D. It is evident that if pins be inserted in holes, say, at *a*, *a* or at *b*, *b*, they will afford points of resistance to a bar that is laid against them when pressure is brought to bear about its central portions by the screw, C. As the ends of the bar cannot yield, the result is that it will become bent. By shifting the positions of the pins into other holes, the curvature of the bar can be varied at pleasure.

Fig. 4 illustrates another method of the making of a ring upon the bending block shown in the previous figure. A is the block itself; B is a sweeped templet casting, cottared down to the levelling block through the medium of rough holes cast in the sweeped templet, the pins passing through any of the holes cast in the bending block that happen to be conveniently situated. The block is set so that its curvature is made to follow round some particular hole in the bending block, in order that the radius bar or lever, C, with its roller, D, may operate with equal pressure upon the ring E in every position. The lever moves upon a substantial pivot, F, whose shank or pin passes through the plate, and is cottared below. The detail of this fitting is shown in Fig. 5, where F is the solid body of the shank, whose pin, G, passes through the bending block, A. H is the pin upon which the bar, C, pivots, and J is a collar, one or more in number, for adjustment for height. K, K are top and bottom cottars.

One end of the bar, E, to be bent (Fig. 4), being heated, is first secured at one end of the curved templet. As these templets are of necessity of quite a special character, made to suit each special job, and not for general work, it is usually practicable to cast a stop at the end where the bar is first secured. Such a stop is shown in Fig. 4, at L, and in detail at Fig. 6.

This particular templet represents one used for making rings from which to cut the reversing links of the motion work of engines, the links being of the type shown in Fig. 7. Where such links are made in quantity, this is by far and away a cheaper method than forging and filing, or machining each link separately. Making a ring with radius equal to the curvature of the link, it is turned all over in the lathe, and then the separate links are slotted out of this ring—a dozen or fifteen, as the case may be, and all are exactly alike.

In such a case as this, a flat oblong stop, L, cast on one end of the templet block, is suitable. We know that when bending any rigid article it is very difficult to get the extreme ends properly curved—they stick out at a slight tangent. Now, in this case, the stop will hold the end perfectly fast, and the curvature can be commenced from the very end.

To prevent that end from rising during the process of bending, the clip, M (shown in detail at Fig. 6), is made to bear upon it. This is a piece of wrought iron of stout section, pierced with a hole for the cottared pin, N, screwed into the bending templet. The long leg of the clip rests upon the face of the bending block; the short leg is pressed down upon the bar to be bent by the pressure of the cottar. The bar is thus pinched at one end.

The opposite end, if heavy, is supported by one of those kinds of appliances common in smithies (see Vol. II., p. 805, Figs. 114, 115). A man, or two or three men if need be, stand at that end, and pull the bar by main force round the curved templet, the supporting rest being moved along with the bar. The bar has a tendency to crumple up along the portion where the bending is taking place. This is corrected by hammer blows from a sledge. Also to prevent the bar from becoming curved to unequal curvatures, pins are inserted at intervals in holes cast in the plate, and iron wedges, O (Fig. 4), are driven between these pins and the bar.

Much force is required to pull round the roller, D, against the edge of the iron. To avoid having a long lever sticking out in the way, a bar, P, is often slipped over the end of the radius bar, C, and removed when not in actual use. The mechanism of the roller, D, is shown in detail in Fig. 5. A block, Q, slides along the bar, C, and may be wedged at any radius with the wedge, R. A stout bolt, S, is tapped into or forged on this block, and the roller, D, slips over it, and is held up by the nut underneath.

In an ordinary forge fire a heat cannot be taken over a great length. Therefore, after a short section of a bar is bent, say, from twelve to fifteen inches, it has to be released from the templet and put back into the fire to get the next section hot; and so on, and so on, until the entire ring is complete. Each time it is put back on the block the portion already curved is secured with wedges. Sometimes also one or two clips like M (Fig. 6) are cottared down over the bar to prevent it from rising up. When the curvature is completed and the circle formed, the ends have to be welded.

The ends of the ring are upset before being brought into juxtaposition, as is usual in making weld joints. They are spread out in all directions—top, and bottom, and edges. But these upset edges are not welded to each other, but are united by means of intermediate "stick in" pieces, thus:—Into the V-like space on one side formed by the abutting ends, a square bar of iron (Fig. 8, A) is laid, and all being simultaneously brought to the welding heat, a few blows of the hammer serve to produce union of the bar and the ends of the ring. The bar is not cut off to the neat length required at first, but any length of bar that happens to be handy is taken, and the end only is brought to a welding heat, the opposite cold end serving as a porter. After the welding is done, the supplementary end is cut off with the hot set.

The ring is then turned over, and a similar "stick-in" piece, B, welded into the opposite V, precisely in the same fashion as in the first case. Of course, the surfaces and edges are very rough and uneven; but the essential work is accomplished, and the rest is merely a matter of battering off the faces with the flatter, and the trimming of the edges with the hot set and flatter.

A heavy ring such as this cannot be manipulated by hand until the men's hands are relieved of its dead weight. Fig. 9 shows a simple and effective rig-up for this purpose. Use is made of the movable jib, which in some form or another is a belonging of most forges. The jib is pivoted against the wall. Upon its cheeks, A, A, runs the jenny, B, consisting of four wheels and carriage, with depending hook, C.

To this hook is attached a lever having a long arm, D, and a short arm, E. At the end of the short arm there is a square nut, F, screwed to take a coarse, square-threaded screw, G, which passes up clear by the side

of the crane. At the lower end of this screw there is a swivel, H, through which the screw works, being turned by a podger passing through the hole in the boss at the lower end of the screw, G. From the lower end of the

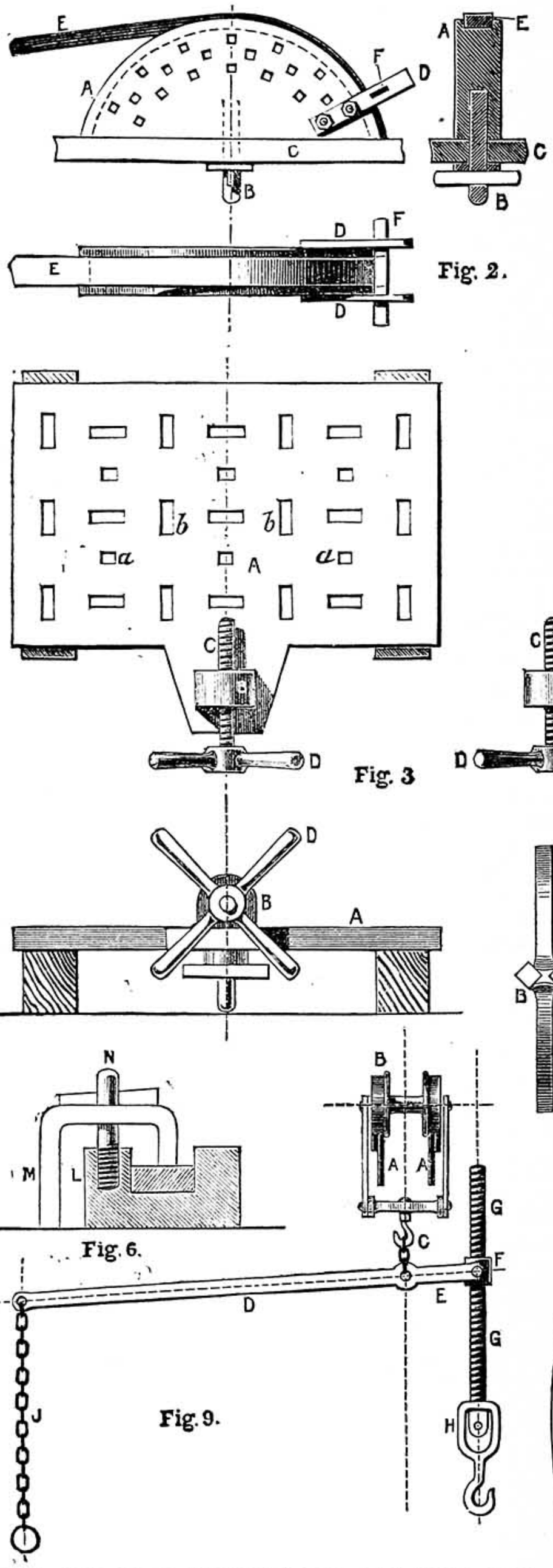


Fig. 2.

Fig. 3

Fig. 6.

Fig. 9.

the ring, being rapid and immediate in action. The exercise of very little force, such as a man can apply with one hand, is sufficient to raise and lower the ring upon the anvil or the bending block. It can then

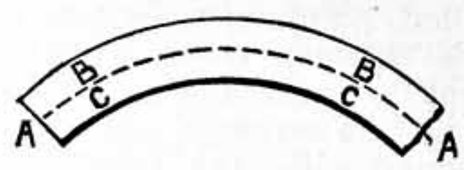


Fig. 1

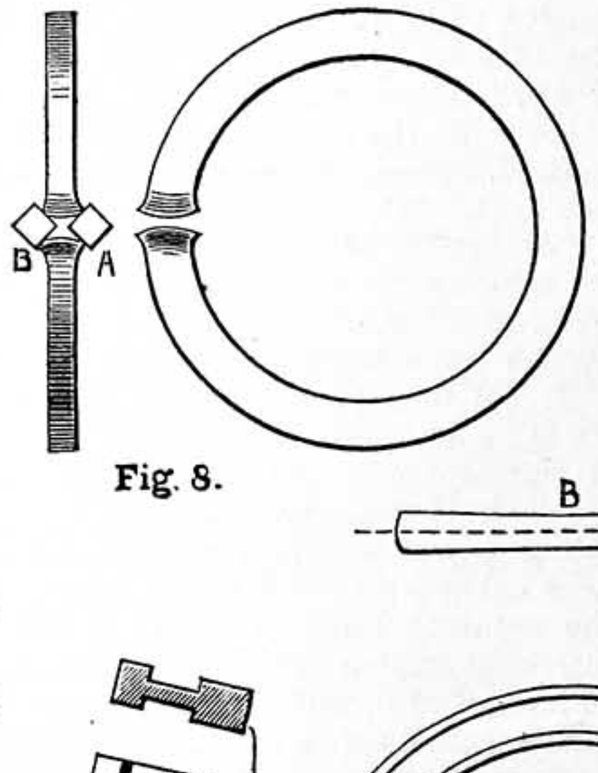


Fig. 8.

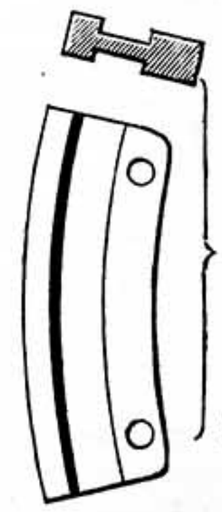


Fig. 7.

Fig. 4.

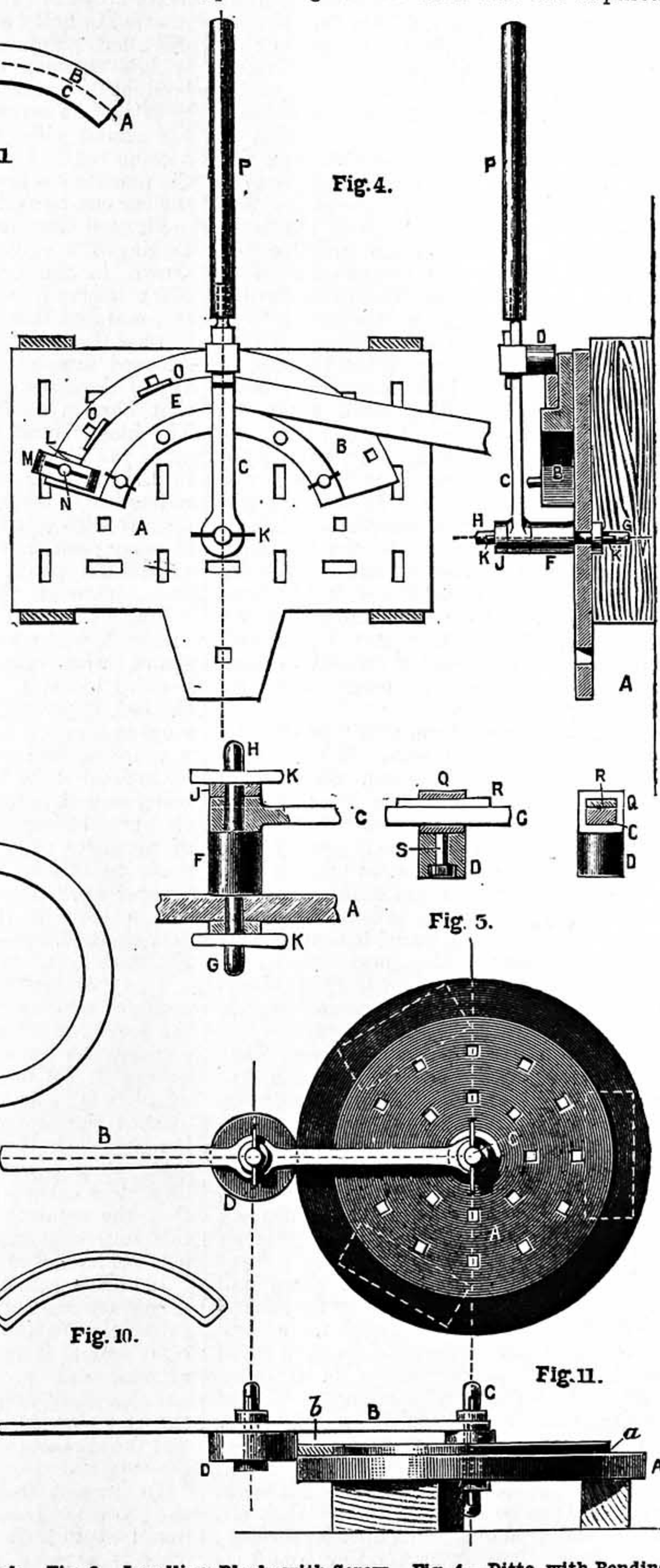


Fig. 5.

Fig. 10.

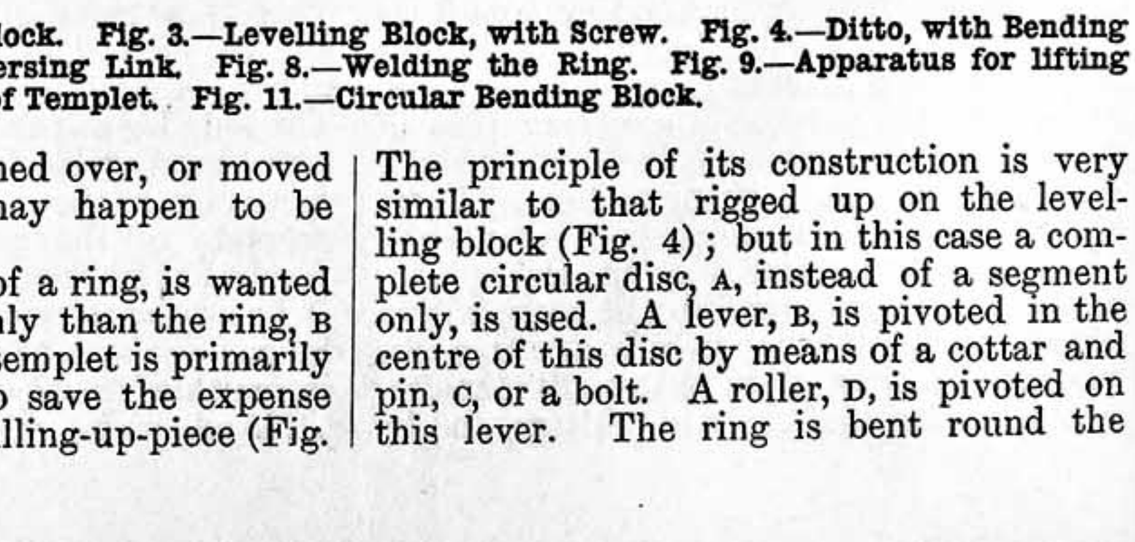


Fig. 11.

Fig. 1.—Diagram to illustrate Tension and Compression. Fig. 2.—Bending Block. Fig. 3.—Levelling Block, with Screw. Fig. 4.—Ditto, with Bending Templet. Fig. 5.—Details of Lever. Fig. 6.—Details of Clip. Fig. 7.—Reversing Link. Fig. 8.—Welding the Ring. Fig. 9.—Apparatus for lifting Heavy Forgings. Fig. 10.—Iron Segment for increasing Radial Capacity of Templet. Fig. 11.—Circular Bending Block.

swivel depends the chain and clip in which the ring is suspended. Now, adjustment can be made of the height of the ring, first by turning the screw, G, the range of height being equal to the length of the screw ; and second, by pulling at the chain, J, at the long end of the lever. The latter is the adjustment used during the manipulation of

be turned about, or turned over, or moved in any position that may happen to be required.

If a ring, or segment of a ring, is wanted larger by a few inches only than the ring, B (Fig. 4), for which the templet is primarily made, the smith will, to save the expense of a new block, make a filling-up-piece (Fig. 10) of square bar of the width required to make up the difference in diameters.

Fig. 11 shows a block of a useful type for employment when a large number of complete rings of the same size are required. The principle of its construction is very similar to that rigged up on the levelling block (Fig. 4); but in this case a complete circular disc, A, instead of a segment only, is used. A lever, B, is pivoted in the centre of this disc by means of a cottar and pin, C, or a bolt. A roller, D, is pivoted on this lever. The ring is bent round the

annular recess, *a*, in the disc, and the roller, being pulled round with the lever, is pressed against the edge of the ring, which, confined between the roller, D, and the edge of a recess on the disc, as shown by shading at *b*, cannot fail to become circular.

The ring will have to be held down at various sections with clips, as in the previous example, for which purpose the holes cast about the central part of the disc are utilised.

A templet like this can also be used for rings slightly larger in diameter and of different widths, by placing rings around the central portion, *a*, of the recess, and by altering the diameter of the roller, D. It is, of course, not necessary that the periphery of the roller should coincide with the periphery of the disc. If the ring to be turned is larger than the outside of the disc, then the roller will be correspondingly smaller. If the ring is smaller than the disc, then the bottom of the roller will touch on the bottom of the recessed portion.

When a smith wants bending blocks of this kind, it is as well to know that complete wooden patterns are seldom made for them. If a pattern segment of the block is given to the moulder, with a sketch or drawing of the complete block, with suitable instructions, that is all that is required. The moulder will place also any number of plain cores in the mould for the pin-holes with sufficient approximation to the accuracy wanted in work of this class.

A DRYING-HORSE FOR BOOTS.

BY HIRAM PRICE.

STANDARD FOR BOOT-HORSE—IRON RACK FOR BOOTS—FASTENING RACK—ALTERNATIVE RACK IN WOOD.

BEING some time since, in muddy weather, at a house where all domestic matters were admirably managed, I observed that each evening at bed-time a board, on which were ranged the boots and shoes of the family—a numerous one—was placed before the fire-place. The board served as a tray; all the boots were brought in upon it bodily, and could in the morning be carried upon it altogether to the place where boots were wont to be blacked. The idea struck me as a good one, yet the arrangement had certain defects—the boots were not raised to a level with the grate, and did not, therefore, derive all the benefit they might have done from the drying fire, and as they rested on their soles, those parts which needed it most had the least chance of drying. I put on my considering cap, and debated with myself how I might best improve upon the plan for the advantage of my own household.

The result was the contrivance shown in the three first of the annexed diagrams, which I find to work satisfactorily.

The end elevation (Fig. 1) is one of the two standards of my boot-horse. I cut it from stout board, the upright piece being, of course, mortised into the foot. It is of such a height as to bring the boot well up to the level of the grate. I made the standard of my own horse 2 ft. high—which, I imagine, would be a fair average height—but some grates might still need it to be a little bit higher, some a little lower. In this diagram, A and B are the ends of two wooden bars (indicated by the same letters in the front elevation, Fig. 2), which act as braces to hold the horse together; the upper rail, A, is, moreover, the handle by which the contrivance is lifted.

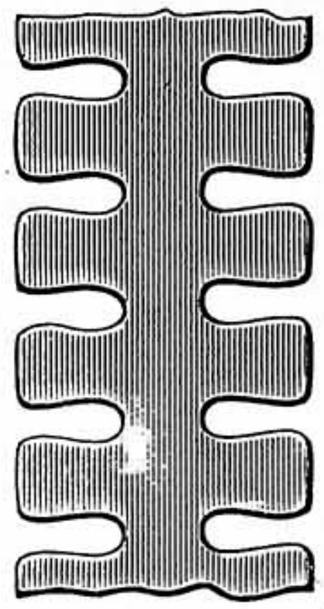


Fig. 5.

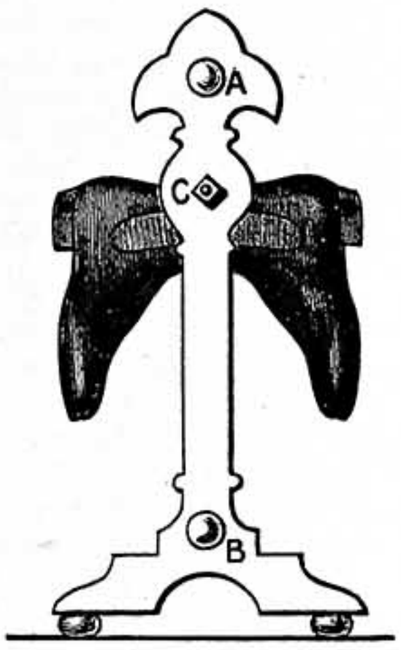


Fig. 1.

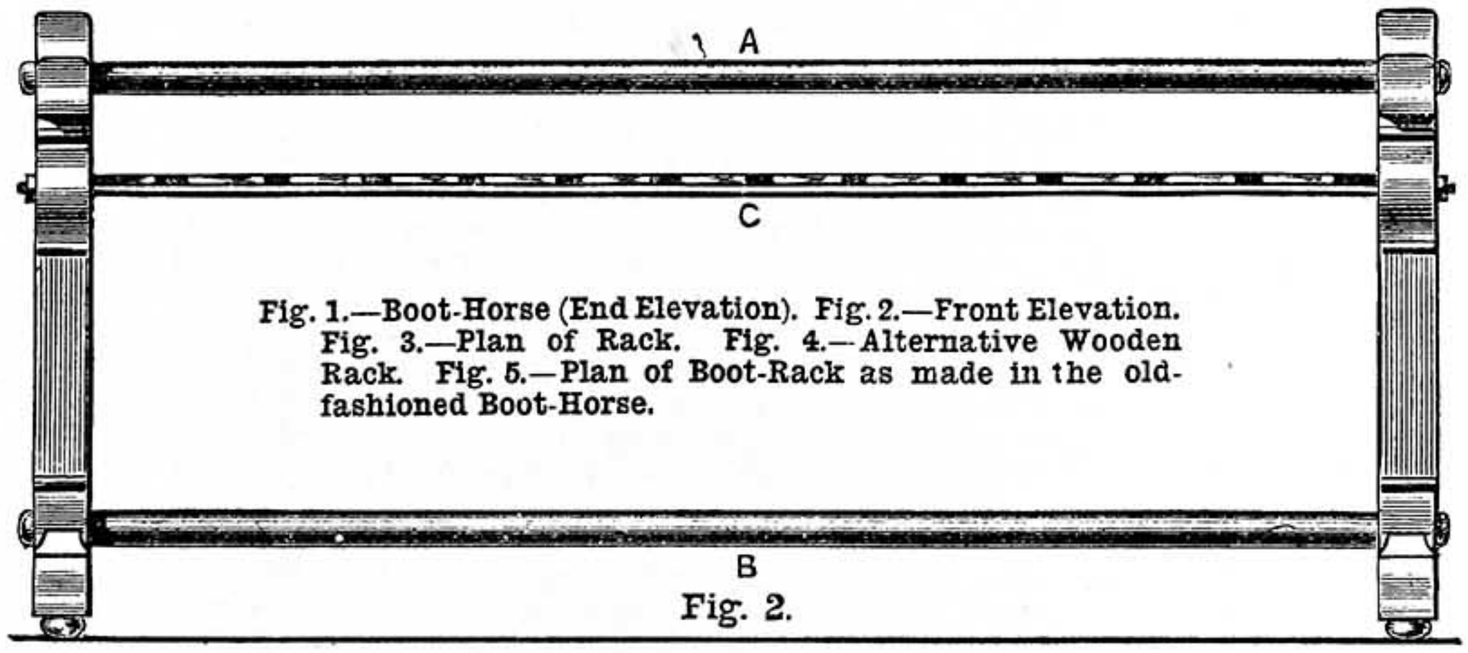


Fig. 1.—Boot-Horse (End Elevation). Fig. 2.—Front Elevation. Fig. 3.—Plan of Rack. Fig. 4.—Alternative Wooden Rack. Fig. 5.—Plan of Boot-Rack as made in the old-fashioned Boot-Horse.

Fig. 2.

Fig. 3

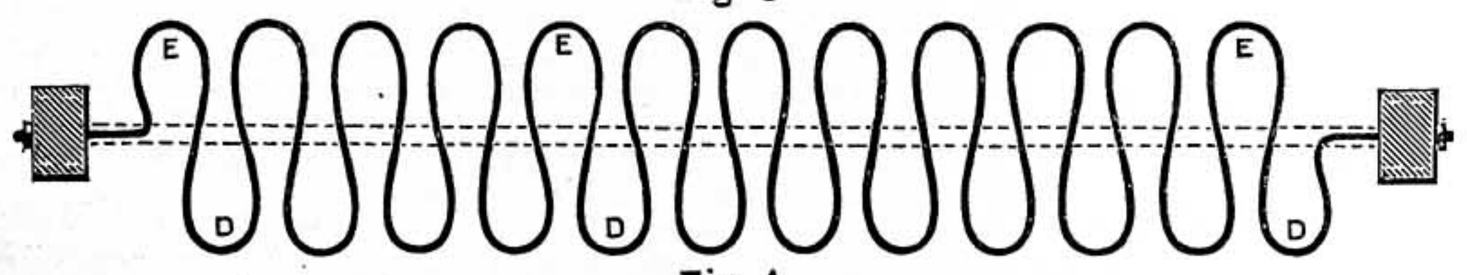


Fig. 4.

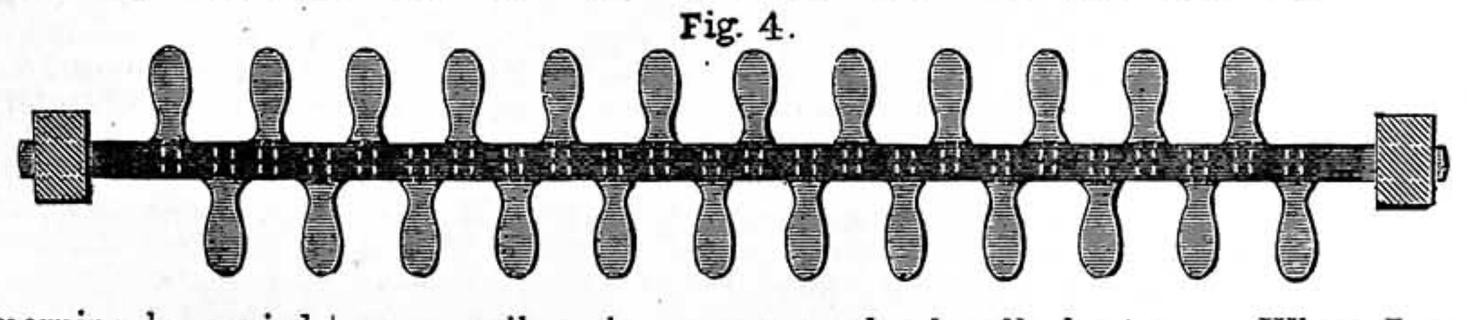


Fig. 3 gives a plan of the iron rack to hold the boots. All other parts I made myself, but for this I called in the aid of a blacksmith. It is made of a thin ($\frac{3}{4}$ in.) rod of iron, bent into the waved form sketched in the figure; and as, when thus bent, it would of necessity give way under its load of leather, it is supported by the stouter iron rod, indicated in the plan by dotted lines as running beneath its centre. To this at its ends it is welded. This stouter rod passes through the uprights, and is secured by nuts, as shown at C, Fig. 1. In Fig. 2 the rack, seen edgewise, is marked C.

Supposing that the side of the horse on which are the points, D, D, D (Fig. 3), is that set nearest to the grate, all the boots hung upon it would have their soles brought opposite to the fire, and be in the most favourable position for drying; whilst those on the side E would have their upper leathers nearest the grate, and at a more respectful distance, which, indeed, would be better for the boots. In some cases only the soles may need much drying, and these may be hung on the side E; if all need drying equally, the whole horseful may be turned in a moment.

The horse before us is 4 ft. 6 in. in length—longer, indeed, than most families would need, as it is capable of drying a dozen pairs of boots at a time. But by making it of this length, I wished to show how easily the comfort of the largest family might be provided for in this particular. In most houses a shorter horse would suffice—my own is 3 ft. long. A horse of a greater length than that given would be cumbersome; and should my plan be adopted—as it might be with advantage—in schools or hotels, I would recommend that instead of a longer horse, *three* horses of moderate lengths should be provided, which, being arranged so as to form a sort of fender round the fire-place, all warmth would be utilised.

The iron rack is, in my opinion, strongest and best for the purpose, and well worth its trifling extra cost; but as it is to home-workers, like myself, that this contrivance will more particularly recommend itself, and as many home-workers like to carry through any work they undertake from beginning to end with their own hands, I give an alternative rack in wood, which will be an efficient substitute. This is shown in plan in Fig. 4. It consists of a centre-bar, made of 1 in. or $\frac{3}{4}$ in. board, 3 in. deep, along the middle of which, at intervals of about 2 in. from centre to centre, are bored a series of $\frac{1}{2}$ in. holes; into which, on each side alternately, pegs are glued—the pegs being sawn from $\frac{3}{4}$ in. or $\frac{1}{2}$ in. board.

The scale on which the diagrams to this Drying-Horse for Boots are drawn is 1 in. to the foot.

[Of a truth, there is nothing new under the sun. When I was a boy, far away back in the thirties of the century, when the glorious memories of Waterloo were far fresher than they are now, being revived from year to year by the annual recurrence of the Waterloo Banquet, and when Wellington boots and Bluchers were generally worn, I remember, among the equipments of my father's bedroom, a boot-horse of solid mahogany, very much like the drying-horse described by Mr. Price. It differed from the latter in being as high as a towel-horse. The standards were connected by three rails—one at the top, one in the middle, and one at the bottom. In the top rail were inserted on each side turned mahogany pegs, on which shoes and slippers were hung; and on the upper surface of the central rail was placed a shelf, notched,

as shown in Fig. 5, to take Wellington boots and top-boots, the boots being inserted in the notches, soles upwards, just below (according to this position) the stiffened part of the heel. Furniture was furniture in those days: as witness the fine old carved four-post bedsteads. I have never met with more than two of these old-fashioned boot-horses; but, doubtless, some are to be found, even at the present time, in good old country houses.—Ed.]

OUR GUIDE TO GOOD THINGS.

*** *Patentees, manufacturers, and dealers generally are requested to send prospectuses, bills, etc., of their specialities in tools, machinery, and workshop appliances to the Editor of* WORK *for notice in "Our Guide to Good Things." It is desirable that specimens should be sent for examination and testing in all cases when this can be done without inconvenience. Specimens thus received will be returned at the earliest opportunity. It must be understood that everything which is noticed, is noticed on its merits only, and that, as it is in the power of anyone who has a useful article for sale to obtain mention of it in this department of* WORK *without charge, the notices given partake in no way of the nature of advertisements.*

48.—The "Art Decorator."

If I remember rightly—and it is scarcely worth while to refer to back numbers, or even the Index to Vols. I. and II. of Work, to see whether memory is right or wrong, when time presses, and much has to be done under its pressure—the *Art Decorator* has been already mentioned in these pages. Nevertheless, its publishers, The Electrotype Company, 80, Fleet Street, London, E.C., have sent me some specimen pages (forming together Part 19 for July, 1891), and these pages, or sheets of drawings, which are sent out in a wrapper, are, generally speaking, so cheap and so good—the Parts being sold at 1s. each—that it is well worth while, in the interest of the readers of Work, to call attention to it again. The illustrations, or rather the sheets, are five in number, and if the title page and contents of Vol. II., which is included in the Part, be taken to rank as equal to one of them, the average price of each sheet is 2d. The first sheet, in black, gold, and white on a grey tint, is devoted to emblems of great artists, including Dürer, Holbein, Michael Angelo, Raphael, and Rubens; and, as the characteristic portraits of each are given, the sheet itself is well worth the price charged for the whole Part to decorators who introduce portraits and the human form into their work, as suggested by my valued contributor, "A London Decorator," in his design for a ceiling in stencil for a sitting-room, in Vol. II., page 133. Then follows a sheet of examples for wood inlay, a centre panel and borders, the former being quaint in its introduction of a rabbit and fowls among the foliage, and the whole characterised by elaborateness of design involving the utmost care in the execution. The woods, too, are well set forth in black and white and various tints of brown. The third, a lunette, "The Vine," with two nude figures of children, a boy and a girl, by Professor G. Sturm, is a photo-print by E. Schreiber, of Stuttgart, suggestive of a sketch delicately executed in Indian ink, and this, perhaps, is the gem of the whole Part. Two chromo-lithographs complete the tale of plates—one of three polychrome friezes in Italian renaissance, and the other of two decorative landscapes, rich in colour, suggestive of the Bay of Naples, but with skies savouring far more strongly of our British climate than the cloudless unbroken blue of sunny Italy. To all decorators and amateurs I strongly recommend the *Art Decorator*. A new volume is commenced with Part 19; and I must tell my readers that if the successive Parts are not secured as they appear, the back parts, after a time, like the Sibylline books, are subject to an increase in price. And this is a good and valid reason for not putting off till next year a purchase which you can make now on far more advantageous terms.

49.—Banning's Patent Bottle Brush.

Mr. R. Banning, Mineral Water Manufacturer, 56, Legge Street, Birmingham, has sent me a photograph of his new Patent Bottle Brush, for the inside and outside cleansing of bottles. The bottle brush itself is so constructed that it may be worked, and, from its appearance, I should say, must be worked, in a lathe. Three brushes, consisting of knots of bristles set in twisted wire, are set at one end in a circular piece of lignum vitæ with brass fittings, and at the other end in a circular plate. Another wire proceeds centrally from the lignum vitæ boss, and through the centre of the plate, terminating in a small brush not unlike a shaving brush. The three outside brushes are set at equal distances from one another. Mr. Banning kindly offered to send me one that I might make trial of it; but washing bottles in a lathe is not exactly in my line, and I have no lathe that I should like to put on such watery duty. He has made trial of his invention now for about six months, and as he says his object is to sell his patent rights, I have now done as much as I well can in giving his address and mentioning the existence of the brush. It seems to me that it is likely to be useful in any place in which the washing of bottles is carried on on a large scale; and as ale and wine bottles can be washed with it, it is to be presumed that it is a good bottle washer all round.

50.—Biggs's Patent Tubular Reversible Locks.

Some time ago, a gentleman living in the neighbourhood of Northampton called my attention to Biggs's Patent Tubular Reversible Locks, which are sold by Messrs. A. M. Perry & Co., of that town. I wrote to Messrs. Perry & Co., asking for samples, and they forwarded my letter to the Tubular Lock Syndicate, Limited, from whom I received a reply enclosing drawings and press notices, but no samples, so that I am unable to say anything respecting the locks themselves beyond what I can gather from the papers mentioned. Moreover, I was bidden to note this:—"Of course, if you put a notice in your paper it must be free of charge." This was unnecessary, as no charge for notices of articles in Work has ever been made, or will ever be made, but it seems to intimate that it is not every paper that is as blameless in this respect as Work. This, however, the Tubular Lock Syndicate, Leadenhall Buildings, London, E.C., did not know, and so made a slight mistake through want of better knowledge of Work and its aims and purposes. I may add that, as many of my readers very well know, samples sent for inspection are always returned if a request is made to that effect. Although I cannot speak of these locks by experience, I know the Yale Lock, which seems to be made on similar lines, and I can testify to the goodness and utility of that. All tubular locks are easily fitted and fixed, and they are particularly well adapted for the purposes of amateurs in every way. Therefore, I trust that such of my readers who want locks for new doors and new drawers will do as I intend to do when I am wanting this kind of thing—namely, give Biggs's Patent Tubular Reversible Lock a trial, and if they like it mention it to their friends. Handles of doors, too, for the most part are troublesome things, but the Syndicate supply a great variety of mortise lock furniture in fancy woods and brass, to be used with the tubular locks, and which appear to be unique in the manner of fixing, and likely to be far more durable than the door handles in ordinary use. These door handles are made on Pitts's Patent.

*** I have to acknowledge the regular receipt of *The Machinery Market and Exporter*, published at 181, Queen Victoria Street, London, E.C., and *The Amateur*, published by Mr. Henry Zilles, 24 & 26, Wilson Street, Finsbury, London, E.C. These serial publications are well worthy the attention of all readers who take an interest in machinery and all kinds of wood-working of an ornamental character.

The Editor.

NOTES FOR WORKERS AND HINTS TO INVENTORS.

Hot-Air Engines.—Amateurs of an inventive, as well as constructive, turn of mind may usefully direct their attention to a much-wanted article—a really light and *cheap* hot-air engine sufficiently powerful to drive sewing-machines, fans, etc. Those at present in the market are all too clumsy and heavy. Robinson's, recently described and illustrated in several technical journals, most nearly approaches the ideal pattern, but is open to much improvement in the direction indicated.

Piano Hammers.—Nearly all the hammers made for English pianos have a tendency to harden on the striking face after a few years' use. The felt buffing becomes partly compressed and partly worn away, the result being that the strings emit an unpleasant "tin-kettle-like" sound. As re-buffing the hammers in many parts of the Colonies and India is impracticable, except at a heavy cost for transporting the instrument to one of the large towns where repairers can be found, some device to either easily replace the old buffing with new or, perhaps better, change the entire hammer head would find much favour.

A Very Novel Advertising Machine.—Inventors are frequently asked if they cannot devise some entirely novel method of advertising. Originality in such a direction, however, seems somewhat difficult, if, as is usually stipulated, cheapness and efficiency have to go hand in hand. It has been reserved for an American genius to suggest a device, the home manufacture of which is within reach of the humblest purse, while dispensing with the services of the bill-poster, or the space of a show-window or hoarding. It consists in an "advertising arrow," projected from a toy gun of somewhat greater strength than that usually sold to children, and intended to be fired at trees, fences, wooden buildings, etc. etc., which the sharp point of the arrow will readily penetrate. It certainly has the defect of being useless against stone or brick buildings, but there is wood enough still employed throughout all civilised countries to give the new idea a pretty wide field of operation.

The arrow is feathered with light cardboard in four sections, upon which the advertisement desired may be printed, while the heel is bound round with cord to keep the cardboard in place. The gun, of which elastics form the springs, has a longitudinal kerf slit along its entire length to allow one of the card "feathers" to travel in it. If preferred, the advertisement printed on a tag may be attached separately to the arrow. To people in want of a new method of advertising, this device will commend itself, especially in country districts.

"Castography."—Our French contemporary, *La Nature*, describes an ingenious method of producing ornamental designs on cardboard, to which the inventor, Mr. Mills, an American, has given this title. It must, however, be premised that only people possessed of some artistic talent could essay the process, which consists in going over the outlines of a drawing or written device upon the card with a very sharp penknife, held so as to form a more or less acute angle with the surface. With the back of the knife, the portion cut is raised so as to be converted into a sort of bas-relief, and this, on being illuminated sideways, presents lights, half-lights, and shadows, such as would result from a carving in stone. It is not easy to secure the necessary effect on a first trial—the tendency of the knife, which must be very sharp pointed, being to slip through the cardboard. This, however, is soon overcome by practice, though few are likely to acquire the lightning rapidity of Mr. Mills, who produces most beautiful effects in less than a minute, dispensing with any previous outline. Some approach to the idea has already been made by the stamped lamp-shades on sale at many well-known establishments, but they do not compete with the artistic results achieved by the ingenious American. Readers, anxious to find a new way of passing spare time, might do worse than turn their attention to this interesting occupation.

SHOP:

A Corner for Those who Want to Talk It.

*** *In consequence of the great pressure upon the "Shop" columns of* Work, *contributors are requested to be brief and concise in all future questions and replies.*

In answering any of the "Questions submitted to Correspondents," or in referring to anything that has appeared in "Shop," writers are requested to refer to the number and page of number of Work *in which the subject under consideration appeared, and to give the heading of the paragraph to which reference is made, and the initials and place of residence, or the nom-de-plume, of the writer by whom the question has been asked or to whom a reply has been already given. Answers cannot be given to questions which do not bear on subjects that fairly come within the scope of the Magazine.*

II.—Questions Answered by Editor and Staff.

Speed of Waggon. — Inclined Plane. — The friction of the usual railway waggon properly made, with its bearings well lubricated, is about 8 lbs. per ton on a horizontal line. This corresponds to an inclination of one in 280, so your waggon should start and run on rails with the inclination you give: viz., one in 108. The accelerating force on the waggon will be to that of gravity acting directly in proportion to the rate of inclination; thus, if v = velocity per second in feet acquired after the force has acted for one second, then $v = \frac{32{\cdot}2}{108} = 0{\cdot}298$ ft. per second if there is no friction; but the friction represents an incline of one in 280, and, therefore, all there is left to cause motion is a rise of $1 - \frac{108}{280}$ in 108: that is, a rise of $1 - 0{\cdot}385 = 0{\cdot}615$ in 108, or 1 in 175·56. This gives for the accelerating force parallel to the rails $\frac{32{\cdot}2}{175{\cdot}56} = 0{\cdot}183$. Replacing g or 32·2 by this in the ordinary formulæ for falling bodies, your questions are solved as follows:—If d = the distance (corresponding to height in falling bodies)

$$v = \sqrt{2\,g\,d} = \sqrt{2 \times 0{\cdot}183 \times 99} = 6{\cdot}019 \text{ ft.}$$

per second at the end of the run, giving an average velocity of $\frac{0 \times 6{\cdot}019}{2} = 3{\cdot}0095$ ft. per second. If t = time in seconds to make the run, then—

$$t = \frac{2\,d}{v} = \frac{2 \times 99}{6{\cdot}0195} = 32{\cdot}89 \text{ seconds.}$$

You may not find this realised in practice, for two reasons. First, the data I have taken for friction may not apply to your waggon; second, no allowance for resistance of the air has been made, but as the speed is so low this would hardly be perceptible. You can, of course, apply this method with other data.—F. C.

Cracked and Dull Polish.—Table Top.—The top of your table has, undoubtedly, been hurriedly finished. The cracked, dull surface to which you refer is known in French polishers' parlance as "sweating." It may be due to the fact that the workman was insufficiently paid for his labour, so could not afford to spend the necessary time on it to turn out work that will "stand"—*i.e.*, retain for an indefinite time its original lustre; or it may be that too much oil has been used. The fact that only the table portion is cracked and dull would serve to show this, this portion having been finished out with the rubber. The turned portion being mostly varnished out, consequently less oil is used there. It would, of course, be better for you could you employ a French polisher's services for a few hours. He would probably soon restore it by working it up again with a little polish and spirits. If you do not, as you say, care to employ one, the next best thing to do would be to wash it with a little weak soda and water—common washing soda, the size of a walnut, dissolved in a pint of warm water; wipe dry, then use a little of the reviver made as follows: ¼ pint lime water, ¼ pint linseed oil, thoroughly well mixed; then add ⅛ pint of sweet oil, and well mix; then thin down with nearly ¼ pint of turps. Apply with soft rag or wadding; wipe off with soft clean rag fairly moistened with methylated spirits.—Lifeboat.

Polishing Tool Handles.—Turner.—A sufficient polish for these is sometimes obtained by holding against them, whilst revolving in the lathe, a handful of fine turnings of the same kind of wood as the handles, especially if wiped over first with a little linseed oil. Many turners use the following:—Dissolve 1 oz. of sandarach in half a pint of spirits; shave 1 oz. of best beeswax in sufficient turps to form a paste. Mix the two together by degrees. Apply with a woollen cloth whilst the work is in motion; polish with soft clean rag. Thus treated, they should appear as if highly varnished; whilst others apply a little French polish with wool or flannel, finishing off with a few drops of methylated spirits on a piece of soft chamois leather; others, again, simply press a piece of beeswax against them while revolving. Experiment with these till you find the one to suit your purpose best.—Lifeboat.

Polish Reviver.—Piano.—I have myself long discarded the reviver you mention on account of its disagreeable smell, caused by the vinegar soon turning sour, and have used with satisfactory results one made as follows:—¼ pint lime water, ¼ pint linseed oil, thoroughly well mixed; then add ⅛ pint sweet oil, well mixed; then thin down with nearly ¼ pint of turpentine. Apply with wadding or soft rag, wipe off, and finish with soft clean rag fairly moistened (not wet) with methylated spirits. Of course, if the work is very dirty or sticky with wax, it should be well washed with weak soda and water to be effective. I find this reviver and the mode of using it the best, for, apart from the doing away with the disagreeable smell, and dispensing with the use of wax—which, by-the-bye, has little to recommend it as of use in reviver, except as a dust accumulator—I find that if the reviver does not bring up the work so satisfactory as desired, it is easy to take a rubber of "half and half" and work it out, thus bringing up the polish to its original lustre: a thing next to impossible if using many of the so-called revivers.—Lifeboat.

Tinning Copper Pans.—J. F. (*Elgin*).—You wish to know how to re-tin copper stewpans that have been tinned inside and out. These articles are more correctly termed bain-marie pans, or bain-marie pots, as some call them. They are some trouble to re-tin unless you have the use of a large bath of tin, in which case there is no difficulty in the matter, as after the usual pickling, scouring, etc., with which I presume you are acquainted, they are placed in the bath, and tinned by rubbing with the tinning rod, with an occasional dip all over to keep them hot, and, when well tinned and thoroughly hot, lifted out and rapidly wiped. I have, however, had to do them when limited to half an ingot of tin—about 14 lbs. In this case I make a square pan of stout sheet iron, dog-earing the corners to prevent the molten tin from running out. This pan must be large enough to allow the largest pan to lay in on its side, handle as well; place a pan in the tin (when melted over the fire), and flow or splash, as it were, the tin on to the pan. Keep turning it over, so as to get it equally hot all over. To do the inside of the bottom, it will have to be stood upright in the pan, and well rubbed with the tinning rod, using plenty of finely-pounded sal-ammoniac. When completely tinned, wipe as usual. Some tin them all first, and then remove the pan, and make each one hot again over a clear charcoal fire, and wipe. You will perhaps find this the easiest way. A little dust of sal-ammoniac thrown on as you begin to wipe will help a great deal. To wipe the insides, especially of very small ones, a piece of stick with tow tied round it will be found useful. With regard to the measuring for price, they are measured from lag to brim—that is, diagonally from one side of the bottom to the other side of the top—but half as much again is allowed for the extra tinning; for instance, a bain-marie pan measuring 8 in. would, if paid for tinning at 1d. per inch, which is a fair price (for the tinning only, not to the customer), be reckoned as 1s.; a 6 in. pan would be 9d., and so on; covers the same. One caution, in conclusion: do not get the tin too hot so as to burn it; it is no joke to spoil 14 lbs. or more of block-tin.—R. A.

Size from Parchment Scraps.—Workonian.—We doubt whether size could be bought positively made from the above. To make it, the scraps of parchment should be put in a bag (flannel by preference), which must be hung in a vessel of water and boiled till the parchment is boiled down. By removing some of the water, and ascertaining if, when cool, it sets to a clear jelly, it will be seen whether the boiling is sufficient; when it is, squeeze the bag (but not too hard) to force out the remaining gelatine. Evaporation by boiling will make the size stronger if required.—S. W.

Sale of Poisons.—Raynor.—By the Pharmacy Act of 1868, which please consult, it is enacted that none of the poisons there enumerated shall be sold by any person unless he be registered as a chemist and druggist. This applies to poisons whether sold alone or in combination. Raynor should get the above Act, with any additions that have since been made (which he can do through any bookseller), and see whether the poison in which he is interested is one of those mentioned, or whether it comes within the meaning of the Act.—C. C. C.

Lead Burning. — A Plumber, H. W., and Others.—A lead-burning machine is a self-acting, self-regulating gas generator for giving a continuous current of hydrogen gas. It is a cylindrical vessel, about 3 ft. high and 12 in. in diameter, divided into three compartments, having communication with each other by means of pipes and stop-cocks. Zinc cuttings are placed in the bottom one, and dilute sulphuric acid in the top, and the gas generated by these two substances when in contact with each other flows into the second chamber, and thence to the blowpipe, where it combines with air under pressure. I cannot give you a sectional drawing, as I have never had one to pieces; but I must say that I do not think it would be practicable for you to make one yourself with the sole aid of a drawing and description. There is a patent lead-burning machine and blower manufactured by Mr. P. J. Davies, 78, Earl's Court Road, Kensington, that I have heard highly spoken of, and as you reside in London it would be worth your while to call and see it. Mr. Davies is a well-known plumber, and author of a standard work on plumbing, and would, no doubt, be pleased to show you the machine and its working.—R. A.

Answers in "Shop."—B. A. W. (*Croydon*).—Replies in "Shop" must take some little time before they can appear—for these reasons: There is a great demand upon "Shop"; four pages of the paper have long been devoted to "Shop," and this is rather a large proportion of the journal itself; and all replies are submitted to outside specialists, who are paid to give careful and adequate replies. There is the "good all-round man and London Directory" principle of dealing with correspondence, but this is not adopted in Work.

Chemistry of Photography.—W. T. (*Stratford-on-Avon*).—The best publication you can study is "Hardwick's Photographic Chemistry."—D.

Watch Oil.—W. J. (*No Address*).—Grimshaw & Baxter, 33 and 35, Goswell Road, Clerkenwell, are the sole agents for Ezra Kelley's watch and clock oils. They will also supply you with anything and everything for watch, clock, and jewellery making and repairing, including hands, glasses, etc., and tongs, joints, and catches.—A. B. C.

Fancy Furniture.—Polisher.—By metallising I presume you mean enamelling—that is, giving a painted appearance in many colours of art shades instead of polishing or varnishing in imitation of various woods. Much artistic furniture is enamelled and decorated. If this is what you mean, it is done by mixing dry colours or pigments of the required shade in spirit or oil varnish. For instance, if a bright red is required, vermilion, or its cheaper companion, vermilionette, is carefully mixed with spirit or copal varnish, according whether a quick or slow varnish is required; spirit varnish dries in ten minutes, oil varnish requires at least six hours. If a white colour is required, use flake white; but unless you require it in large quantities, it can be bought much more cheaply at any druggist's or oil and colour warehouse than it can be made. In oil varnish enamels, Messrs. Aspinall, of the Enamel Works, London, S.E.—who advertise in this paper—are considered by some the best known makers; while for spirit enamels, that known as Foo-Chow, prepared by Donald Macpherson, Manchester Colour Works, Knott Mill, Manchester, is as good as any. Both makers prepare it in about one hundred different shades. If, however, you mean by metallising, giving to the articles a metallic appearance in imitation of brass, copper, or silver, they should be first painted any suitable colour, then varnished—which latter, while still tacky or not quite dry, should be wiped or dusted over with gold, copper, or silver bronze powder, or the whole in combination as may be required.—Lifeboat.

Stain for Varnish.—Varnish Stain.—Nothing is as yet known that will dissolve in spirits, similar to Bismarck, and yield a brown colour suitable for a walnut stain. The usual plan is to stain first, then varnish or polish. You may, however, add to your varnish a little brown umber (in the dry state), a dash of black, and a little Bismarck till you have the required shade. Strain through fine muslin before using.—Lifeboat.

French Polishing.—House Painter.—You did not put sufficient polish on your bureau: the three rubbers you gave would not be enough to fill up the grain of oak, especially if you used no "filling-in." No definite rule can be laid down as to the number of rubbers of polish required, some woods being much more porous than others; but in the bodying up the grain should be left filled, and just a little over; then set aside for some hours, or over-night, to allow for sinking. When you take it up again it would require a few more rubbers of polish previous to spiriting out. If at this stage you gradually worked out the polish in your rubber by putting on a few drops of methylated spirits at a time, and worked it out fairly dry, you should leave no streaky marks for the spirit rubber to remove—only a semi-transparent film of oil, to remove which some polishers dispense with the spirit rubber as made of wadding, using instead a swab of clean soft rag, fairly moistened with methylated spirits, and pressed well in, which should be applied to the work very slightly, at first with a straight, then circular, motion, applying pressure as it gets drier. New spirit rubbers in the hands of the inexperienced are very deceptive. One is apt to get them too wet, thereby softening and tearing up the gums instead of clearing out the oil and increasing the lustre. Your chief cause of failure has been an insufficient body of polish, and trying to make the spirit rubber do what the polish rubber should do.—Lifeboat.

Books on Flues, etc.—St. Mungo.—The "Engineers' Practical Guide to the Fixing of Hot-Water Apparatus and Warming Greenhouse and Building" will probably contain some, if not all, of the information you require on flues, boilers, and hot-water work in general. The author of the book is John Eldridge, hot-water engineer. The book is illustrated with plans and sections; the price is 1s. only. Publisher, Spon, London.—R. A.

Electric Belt.—W. S. (*Cambridge*).—The clasp of the belt may be made of copper, brass, silver, German silver, or any other metal, and may be made in any form you may select, providing it forms a complete metal connection between the ends of the row of discs on the belt. The wires do not cross each other, since they are merely short pieces, of about 3 in. in length, connecting each copper disc—except one on the outside—with each zinc disc in the next couple on the inside, except one. A copper disc at one end, and a zinc disc at the other, must be connected to the two halves of the clasp. Thin pieces of steel, 3 in. in length by ½ in. in width, such as crinoline steel in short pieces, well magnetised, then sewn into a flannel belt at distances of 2 in. apart, will do equally as well as this electric belt, and will not need any connecting wires or metal clasp.—G. E. B.

Electrical Instruments.—N. F. M. (*Paddington*).—Complete replies to your four questions would

occupy one whole number of WORK, and would give me a fortnight's hard work. We cannot devote so much time and space to one correspondent. (1) A simple cigar-lighter may be made of a few inches of No. 24 platinum wire made into a spiral, the ends soldered into two strips of copper, and these connected to your battery. The platinum will be raised to a white heat, and will then light a cigar. Space will not allow of a sketch. (2) I cannot tell you here, in "Shop," how to make an ammeter to read from 1 up to 20 ampères. Space cannot be spared for the necessary engravings and description. (3) The foregoing remark applies to your third question, respecting an automatic magnetic cut-out to work with current up to 20 ampères. (4) I do not know the "West Rheostal," so cannot tell you how it is made.—G. E. B.

Electric Candle-Lighter.—A. F. E. (*London, S.E.*).—I cannot clearly understand what you mean by wanting an electric apparatus, "not more than 6 in. square, to give 200 sparks, each of sufficient size and duration to light a candle." If you want an electric candle-lighter in a small space, I advise you to get a pair of the small but powerful lithanode cells made by Messrs. Cathcart, Peto & Co., 57B, Hatton Garden, London; and get them to make for you a portable cigar-lighter, to be worked with current from those cells.—G. E. B.

Repairing Broken Carbons.—R. B. (*Durham*).—I do not know of a method by which broken carbon rods or plates can be cemented together and made "to work the same as if they had not been broken." You may drill holes in the carbons, and put in brass screws, fastening with molten lead. As the carbons are broken off level with the tops of the pots, you will have to get new ones. It rarely pays to repair old Leclanché cells.—G. E. B.

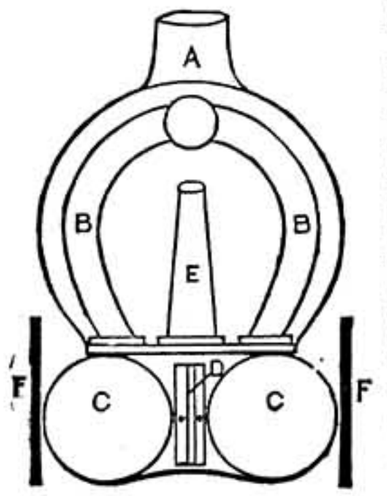
Glass for Overmantel.—WALLSEND.—I deal with J. M. Newton, 7, New Inn Yard, Curtain Road, London. His prices range from 1s. 9d. per foot for the small sizes mentioned by WALLSEND, to 2s. 1d. per foot for plates of 5 ft. in area. ¾ in. bevel costs 3d. per foot, measuring margin extra to the above. The silvering is good (pure silver process), and I have always been pleased with the article supplied.—B. A. B.

Medicine Chests.—H. F. (*Wigan*).—If H. F. wants anything specially good he should write to Betjemann & Sons, Pentonville Road, London, N. If ordinary goods are required, Betjemann, of whom I have inquired, recommend Maw, Son & Thompson, Aldersgate Street, E.C. If H. F. wishes to place orders for a considerable number, he should obtain prices from a *fancy* cabinet maker or a leather-case maker, in that case obtaining a sample for the maker to work to; or better still, devising some improvement himself. The making and lining of these goods are separate trades carried on by different people; liners abound in Clerkenwell, London.—B. A. B.

Fish Glue and Copal Resin.—W. J. P.—Address of dealer in the above commodities: C. W. Waters, 72, Great Eastern Street, London, E.C. This is a firm doing a big business in polish, varnish, lacquers, glues, gums, gelatines, etc. As to terms, "wholesale" will depend on the quantity you wish to purchase, no matter with whom you deal.—F. P.

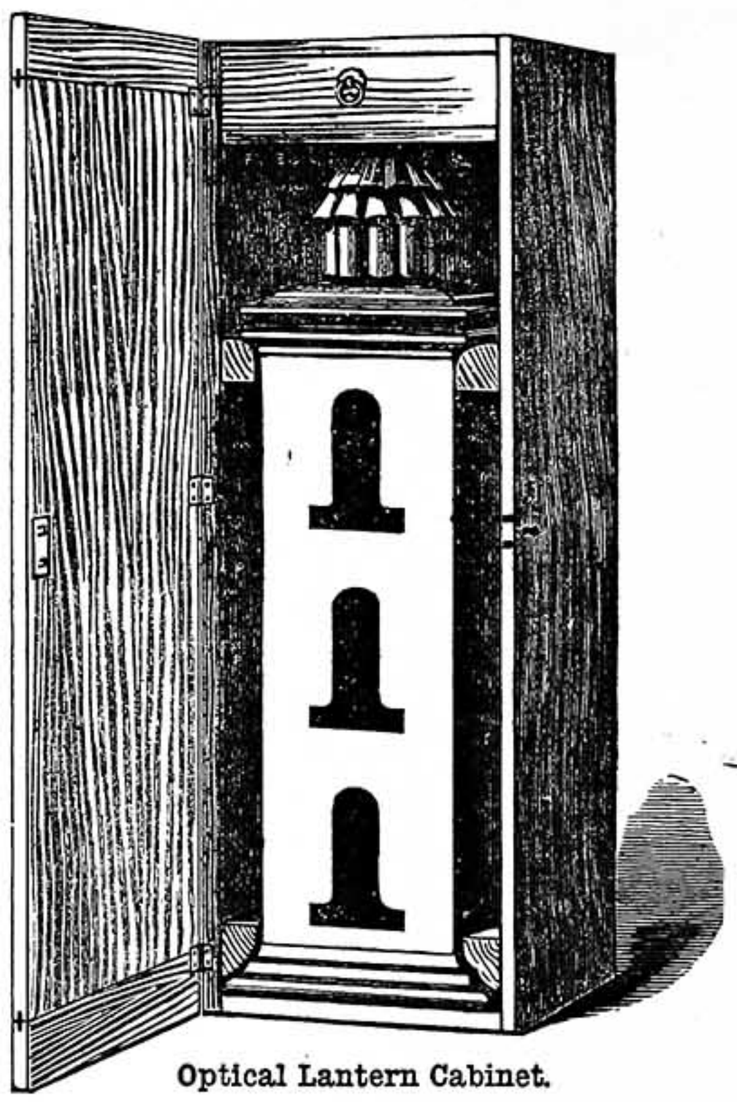
Reflector.—LOVER OF "WORK."—It seems unlikely that a window having a south aspect requires a reflector; but if so, it must be because the light is obstructed by buildings or trees. LOVER OF "WORK" had better try various angles until the result is satisfactory; he will then be doing as others do in similar circumstances. He does not say if his workshop is on the ground floor. This is of importance in deciding.—B. A. B.

Steam Chest.—READER.—(*No Address*).—The steam from the boiler, on passing through the regulator, flows to the steam chest or valve box, in which the slides for admitting the steam to and releasing it from the cylinders are placed, and by their means is permitted to act on each side of the piston. The diagram shows a cross section through the cylinders, slide-valves, and framing of an inside cylinder locomotive, with the steam-pipes to and exhaust-pipe from the cylinders. An examination of this, reference being had to the letters, will, we think, make the path of the steam from the boiler to the cylinders clear to anyone with very little trouble. A is the boiler and funnel; B, B, the steam pipes leading to the steam chest; C, C, the two cylinders; D, the slides or steam-valves; E, the exhaust-pipe, by means of which the steam escapes up the funnel; F, F, the side frames supporting the cylinders, boiler, etc.—C. E.



Locomotive Steam Chest.

Optical Lantern Cabinet.—F. C. (*Londonderry*) asks for a sketch of a travelling cabinet in which to pack an optical lantern. This is an article which will require to be carefully thought out by the operator himself, in accordance with the requirements of the lantern to be packed. In the cabinet shown in the sketch, the lantern is slid into the case in an upright position by means of a door at the back, which is hung with brass butt hinges, and furnished with one or two locks and a pair of handles. Some operators prefer to use pull-off hinges in order that the door can be taken off bodily when desired. Some felt-covered guides should be screwed to the sides of the case on the inside, in a suitable position, to hold the instrument in place, and keep it from moving during transit. The internal arrangements of the case will naturally depend upon the requirements of the apparatus, but at least one drawer should be set aside to contain the usual requisites of the operator, including


Optical Lantern Cabinet.

the tin or bottle of lime, cylinders, a box of matches, a hammer, screwdriver, gimlet, gas pliers, nails and tacks, a few screw hooks, some gas joints and connections, and last, but not least, a measuring tape and some useful lengths of red rubber tubing. Some operators arrange a special drawer for the lecturer's reading lamp, and another for the rubber tubing. Lantern slides must never be packed in the cabinet with the lantern; it is best that they should have a separate box to themselves. Another useful form of lantern cabinet is a shallow box with a deep lid, so that the instrument can be laid on its side, with numerous compartments in every available space between the lenses and hood to take the accessory appliance, the box being made of sufficient size to allow of the screen being laid over the lantern in order to form a soft packing. The various accessories must, of course, be tightly fitted into the compartments, which will naturally require to be cloth lined. The case should be made of straight-grained yellow pine, which may be painted with Aspinall's black or chocolate enamel outside, with "This side up, with care," in white letters on the top.—C. A. P.

Repairing Silver Locket.—QUÆSITOR.—This correspondent wants to repair the hinge of his locket, and from the materials he says he has, he evidently thinks of pewter soldering it. Now, merely pewter soldering one knuckle of the hinge by itself will not do: there is not sufficient hold to be obtained for security, unless a lot of solder is used, and, after all, pewter soldering is a botching way of repairing work where hard soldering is possible. If it has to be done without hard soldering, I should obtain a piece of thick silver or metal wire, fit and drill one end to form the hinge, while the other end should be hammered and spread out to fit on the bottom of the inside of the locket; by these means a strong job will be made. Why not hard solder it? There are many answers in "Shop" bearing on soldering (see WORK, Vol. I., Nos. 14, 19, 38, and 46; and in Vol. II., Nos. 76 and 104). An easy way of repairing the hinge would be to hard solder a piece of flat silver on the knuckle, and pewter solder this in. This will avoid the risk of melting the locket by hard soldering; the risk, however, is not great. There is a reply to T. N. (*Halifax*) on soldering to follow this, which will give you all particulars. If it is not clear then, please write again; and if you have an opportunity, try and see somebody hard solder any article, and note the sort of flame they obtain. Any detail overlooked in these replies will be explained on a note being sent to our Editor.—H. S. G.

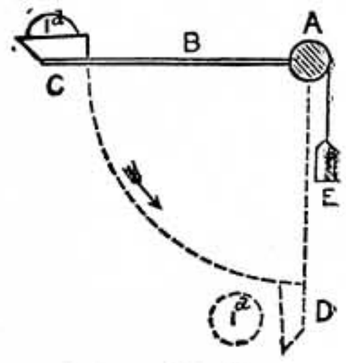
Atkinson's Electro-Motor.—H. J. H. (*Hackney*) and W. H. O. P. (*Homerton*).—Mr. Atkinson's electro-motor, described and illustrated on page 71, Vol. III., of WORK, can be reversed and driven as a dynamo, if the lead of the brushes is altered so that the commutator does not ruffle them; but the current obtainable from the machine when thus driven would not do any useful work. Neither Mr. Atkinson nor myself have experimented with the machine with a view to using it alternately as a dynamo and a motor, so have not determined on the gauge of wire to be wound on the armature and fields. The castings are not sufficiently massive to be used for this purpose. If you decide on trying a set of castings, wind them with No. 24 silk-covered copper wire, and get as much of this on the fields as they will hold. The direction of winding will be the same as for a motor, and the fields must be connected in shunt with the armature. At 3,000 revolutions per minute you may get a current of ¾ ampère, at a pressure of from 6 to 8 volts.—G. E. B.

Electro-Plating.—Z. Z. Z. (*Wednesbury*).—(1) There is no difficulty whatever in electro-plating standard silver. First swill in hot caustic alkali to remove grease, then rinse in warm water. Next, scour off all corrosion, and polish the surface. Again dip in caustic solution, and rinse. Swill next for a few minutes in weak nitric acid, then in quicking solution; again rinse, and transfer to plating-bath. Full instructions in the "Electro-Plater's Handbook," price 3s. (2) To get a higher tint of gold, raise the temperature of your gilding bath, and use another cell to your battery. Work the bath at 160° Fahr. The colour of 18 carat gold can always be given to a deposit of pure yellow gold if you have an alkaline solution of copper in working order. Deposit a thin film of copper on the pure gold, then flash a thin coat of gold over this; rinse, and dry off without scratch-brushing. Practice will give you skill in this mode of colouring gold.—G. E. B.

Power of a Dynamo.—SOLDAT.—The electric power of a dynamo is, or should be, calculated by its designer before it is built, and the calculations are based on the following lines:—First, the volume of current and its pressure is determined, and the machine is designed to give the required volume at the required pressure. The iron for the field-magnet cores is selected of such a size, weight, and quality as to be only half-saturated with magnetism when the full current is passing through the machine. The iron of the armature should be one-seventh the weight of the field-magnet cores. The wire on the armature of a shunt machine must be large enough to carry safely the full current, and its resistance should be one-twentieth that of the working circuit. The value of this resistance is obtained by measurement. The wire on the fields must be large enough to carry 5 per cent. of the total current, and have a resistance 400 times that of armature wire. Series machines and compound machines are of different design to shunt machines. Full instructions are given in the latest edition of "The Dynamo: How Made and Used," by S. Bottone, Wallington, Surrey.—G. E. B.

Solenoid.—J. G. (*Nottingham*).—You get the best result from the Fuller cells connected in two rows of three abreast, because then the internal resistance of the battery is reduced and more current is available to go through the coil of the solenoid. You may wind on more wire until the coils are three times the diameter of the plunger: each extra turn of wire in this direction will increase the pull of the solenoid. An iron tube should not be used, because this absorbs energy which should be exerted on the plunger. You will gain very little by increasing the length and diameter of the plunger. The internal resistance of your battery must be high, or you would have got better results from the six cells in series. To balance this resistance, you must wind on more wire or a finer wire on the bobbin. If you use the larger wire you must also employ larger cells in your battery. Of course, you will understand that I am working in the dark in thus advising you, for you do not give me any idea of the apparatus you wish to work in this way. A few badly-arranged or badly-fitted joints may quite hinder the working of the solenoid.—G. E. B.

Automatic Door.—G. S. (*Skipton*) has made a model of a chapel, and wishes to fit the inside with mechanism which will, on the insertion of a penny, cause the door to open and a figure to appear. Let A in the annexed figure be an axle, B an arm from it extended as far as space will allow, and provided with a cup, C, to receive the penny. The weight of the coin will cause the arm to descend until the 1d. falls out, as at D, when the weight, E, will cause the arm to resume its normal position. The power will, of course, depend on the leverage afforded by the arm, B. By this means nearly a quarter circle motion can be gained; and if G. S. is anything of a mechanician, he can, by taking thought, get from it the effects he wants. He will require a "fly" to retard the descent of the penny, so as to give time for his levers to open the door, push the parson forwards, and pull him back again. Unless I could see the space and arrangements of his model, I could scarcely give him further advice.—C. C. C.



Automatic Door.

Rotating Bookcase, with Map Compartment added.—AMATEUR.—I strongly advise you to adopt the pattern of revolving bookcase shown

here. It is square, and, therefore, there will be an equal pressure all round the central pivot; whereas I gather from the sketches of American case sent, they represent articles narrower at two sides, thus creating an uneven pressure on all parts outside the pivot. If, however, they *are* square, the width may be in excess of that required for the books, thereby wasting space. The English articles are made similar to Fig. 1, but are supported upon cross-shaped feet. Perhaps it may be advisable to

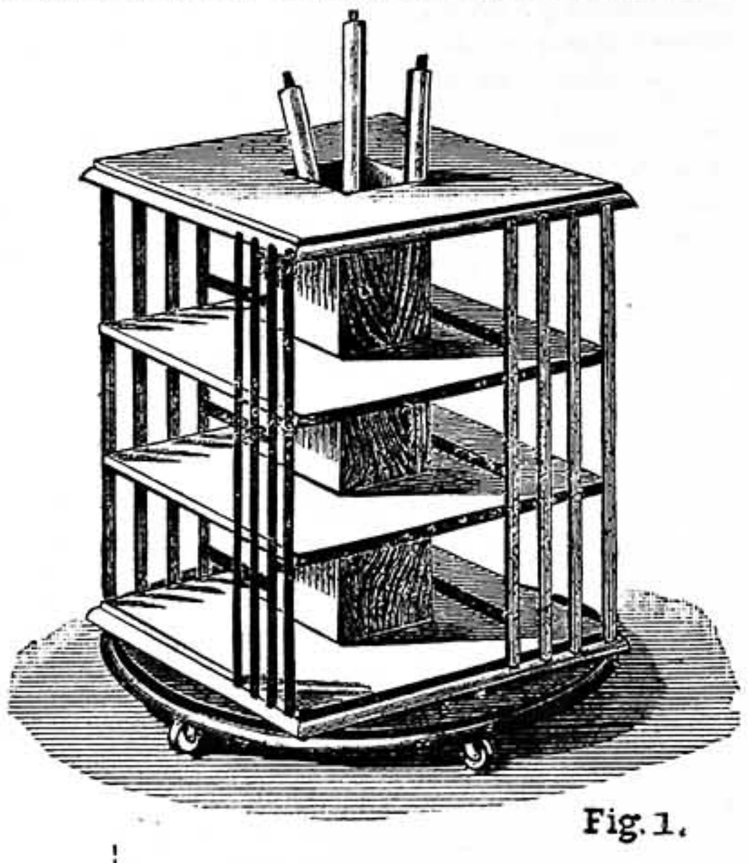


Fig. 1.

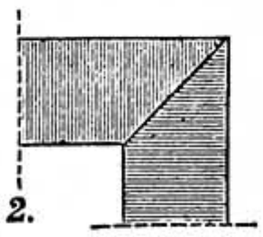


Fig. 2.

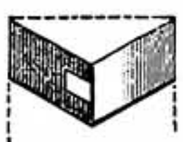


Fig 3.

Rotating Bookcase. Fig. 1. — Bookcase, etc. Fig. 2.—A Corner of Shelves. Fig. 3.—Ditto, exhibiting the form of Joint at Mitre.

support the body upon balls. If this is done, I recommend the cutting of a shallow groove at a few inches within, and parallel to, the circumference of the turn-table, within which you should place three or four metal balls loosely at equal distances apart. Then pivot the body to the turn-table, and the balls will revolve in the groove when the case is turned. I think it is quite a new suggestion on my part to utilise the middle space formed by middle upright boards, instead of covering it in, as is usually done. You could therein store any of your maps when rolled. Join or screw four mitred or dovetailed boards of any desired height (say, about 26 in.) to a bottom board about 2 ft. square and 1 in. thick. Shelves could be mitred up as in Fig. 2, back parts of them being tenoned into the upright boards, and mitres being joined as in Fig. 3. Upright boards could be tenoned into shallow mortises in top board, or merely screwed. Upright rails, of about 1½ in. width, should be pinned as shown, and stop-rails fastened within the case. Wood is obtainable at any timber merchant's. Oak, walnut, mahogany, or any common wood is suitable for this article.—J. S.

Sofa-Bedstead.—H. S. (*Birmingham*).—You ask for a settee with folding bedstead. I presume you

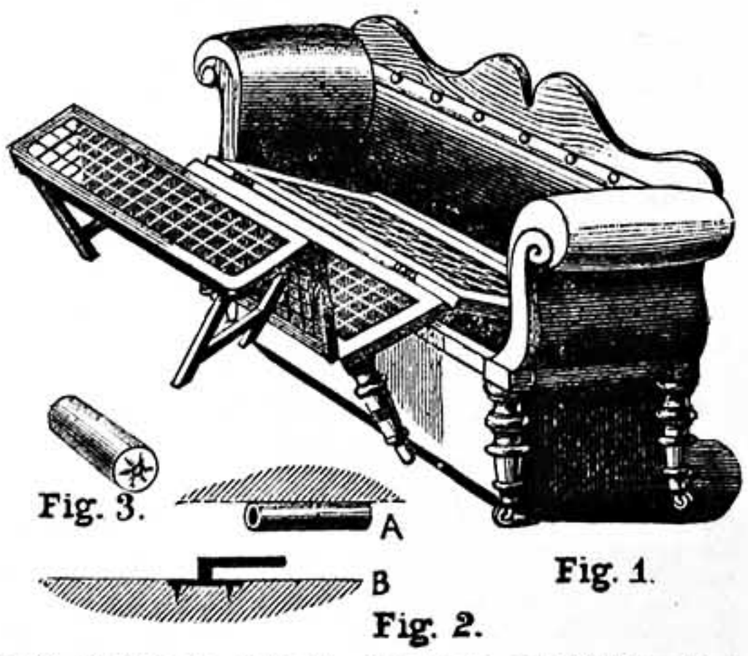


Fig. 3.

Fig. 1.

Fig. 2.

Sofa-Bedstead. Fig. 1.—The Sofa, exhibiting Bed-Frames being unfolded. (The narrow end Frame is separate, and would not fold, as in sketch; but it is so shown to facilitate understanding.) Fig. 2.—Catches to be fixed to narrow Frame and end Bed-Frame. Fig. 3.—One of two Sofa Bolsters.

mean the old-fashioned sofa-bedstead. There is a distinction, but not much difference, between a settee and a sofa. All that you require is shown in the drawings. Of the construction of the sofa proper, I can say nothing more, on account of space, than to advise you to consult Indexes to Vols. I. and II. for details of joinery. To the back of the sofa is hinged a mortised and tenoned framing of a width nearly equal to that of the sofa seat. Two other frames of the same size are hinged to this, and also to each other. Be particular that they fold as shown. You must allow a sufficiently deep rebate on the inner side of sofa framing to allow the bed-frames to lay flush with the edge of the said framing. On to the outside of the end frame (which is towards the front in the sketch) there is slipped a removable frame of about 9 in. width, by means of the catches used upon shop door shutters, of which two of A (Fig. 2) are to be attached to the large end frame, and two of B to the narrow end frame. Webbing will be on top of frames. In recess thus formed in narrow end frame hinge two supports, as shown. The legs attached to large end frame are removable, and secured by means of a spiral screwing into a worm in the frame corners, under which circumstances it is advisable, perhaps, to but half-joint those particular corners. The outside of narrow end frame is to be polished. Underneath the front of it fix two dowels, which will drop, when bed is folded, into holes in edge of sofa frame at the front. When closed, a loose cushion, of 4 in. or 5 in. depth, is placed as a seat, the ends above being occupied by loose bolsters of the pattern Fig. 3. Horsehair bag underneath seat is intended for the reception of the bedding, but, if dispensed with, appearance will gain by its absence. Read my reply (see Indexes) "Press Bed." These bedsteads, as I can testify from youthful experience, are very awkward to handle, although useful articles.—J. S.

Battery Power for Lamp.—CORRESPONDENT.—The battery power required to light up a 10 c.-p. incandescent electric lamp will depend upon the resistance of the lamp filament, or what is popularly known as its voltage. This term is used to convey an idea of the electric pressure required to send the necessary current through the lamp filament, and to raise it to a glowing incandescent condition. The lamps vary in voltage from 12 to 120 volts. Each cell of a bichromate battery will give a pressure of 2 volts, regardless of size. If, therefore, you divide the voltage of the lamp by two, you will get the number of cells required to light the lamp, whatever its candle-power. It follows, therefore, that a lamp of low voltage will take less cells than one of high voltage. But lamps of low voltage take a larger volume of current than those of high voltage; therefore large cells, holding not less than a gallon of liquid in each cell, must be used for low voltage lamps, whilst cells of a smaller size may be employed in lighting a lamp of high voltage.—G. E. B.

Mordey-Victoria Alternator Dynamo.—NED.—"The electricity is produced in a Mordey-Victoria Alternator with exciter" much in the same manner as it is produced in any other dynamo. The exciter is merely a small dynamo furnishing a current to excite magnetism in the cores of the larger machines.—G. E. B.

Drawer Supporter.—A. M. I. C. E. (*West Kensington*).—It seems strange that so little attention has been given to the fact of the tendency of drawers in a piece of furniture to drop upon extraction. The only inventions with which I am acquainted are my own (see Index to Vol. II., price 1d.), and one of which an advertisement and editorial notice appeared in *Furniture and Decoration*, price 6d., issue for Feb. 1, 1890 (Messrs. Smith & Botwright, 6 and 7, Eldon Street, Finsbury, E.C.). The latter, although a simple contrivance in its way, is complicated when compared to my suggestion. Moreover, it is patented, whereas my idea is not patented, whether useful or not, but is (as with all I do) given to my readers to utilise as they wish, without fear of that hawk, the "patent rights," picking holes in them for so doing. I might, in justice to the "drawer equaliser," as it is called (which is made by Messrs. Bate & Kempson, 307, High Holborn, W.C.), say that, as its title implies, it *equalises* the drawer during extraction, while my invention *retains* it horizontally when *almost fully drawn out*. I am not acquainted with any cabinets fitted with drawers with either attachment.—J. S.

Model Printing Press.—HOPEFUL.—This is a subject which will require a separate article in the body of WORK, not in "Shop."

Removing Stains from Marble Mantel-Shelf.—E. L. C. (*Portland*).—Dissolve American potash in warm water, make it into a paste with whiting, and spread the mixture over the marble. If washed off in a few minutes, it will bring with it all ordinary surface stains and discolorations. Obdurate stains may take a longer time—some hours perhaps—but if left on long, the caustic potash is apt to corrode and injure the polish of the surface. Chloride of lime is another good agent to remove obstinate stains. But if smoke has penetrated right into the substance of the marble, I know no way in which it can be removed and the original whiteness restored without taking the shelf to pieces, laying the portions in wet sand so as to leave one surface only exposed, and sprinkling this over with pipe-clay. The moisture rising will generally drive the smoke stain into the pipe-clay; but in some cases this will not perfectly succeed.—M. M.

Planchette.—B. W. (*Manchester*).—Take a piece of ½ in. board, say, 15 in. by 6 in., mount it on four legs, with castors which will admit of perfectly free movement in every direction, and in the middle fix a blacklead (*a*), all as shown in the side view, Fig. 1, and you have planchette. To use it, lay a sheet of paper on the table, and on it set the instrument. The two operators sit on either side, and place their hands upon it, with fingers spread out and thumbs somewhat overlapping, as in Fig. 2. Planchette is secretly asked to answer questions. After a time there is an unconscious movement of the hands, and consequently of the machine (be the cause

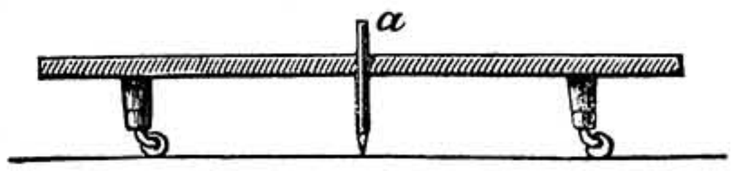


Fig. 1

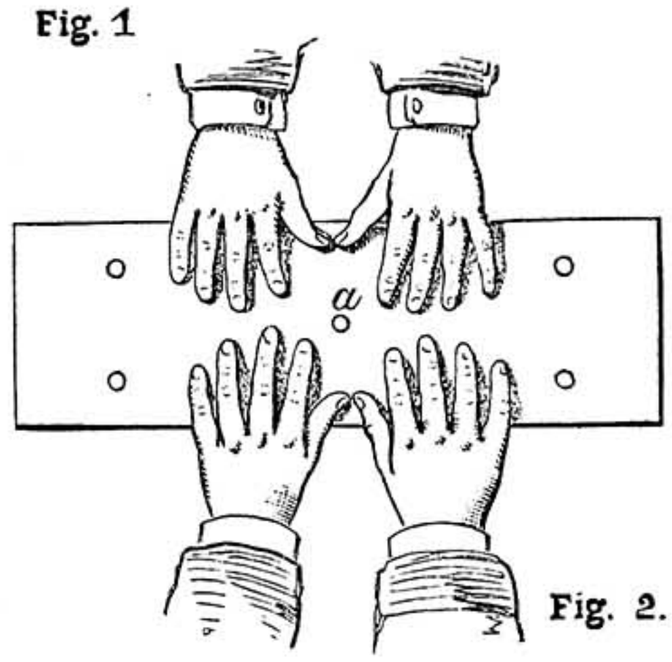
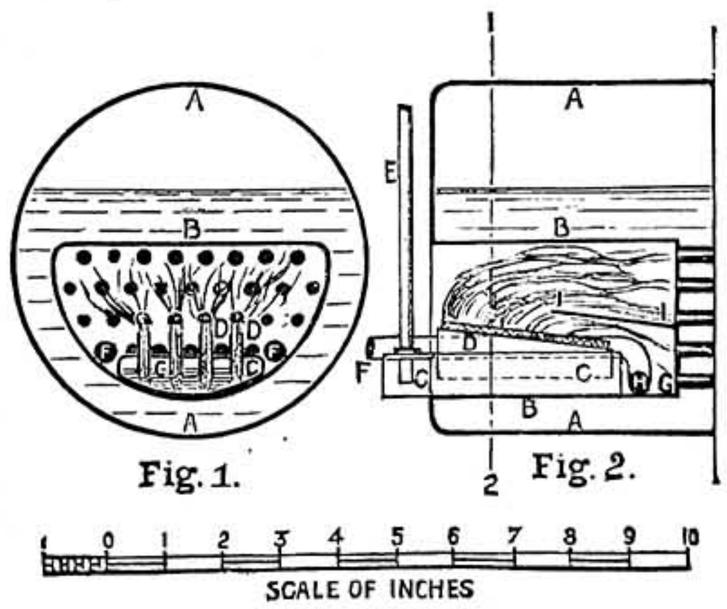


Fig. 2.

Planchette.

what it may), and the pencil, of course, makes scrawls upon the paper beneath it. If faith and ingenuity are present in sufficient quantities, these scrawls may be interpreted into words and answers to the questions asked. In the newspaper cutting sent by our correspondent, we read such marvels as that planchette has written a story which was accepted word for word by a magazine editor. B. W. must be told that the author of this statement is by nationality an American, and by vocation a writer of fiction, and that discount must be allowed accordingly.—S. W.

Marine Boiler.—R. S. (*Oldham*).—You are mistaken in saying you have such a boiler as I suggest on page 174 of No. 115 of WORK, as I describe a *vertical* boiler, and yours is *horizontal*; nevertheless, a paraffin burner may suit your purpose if properly made. As you do not give dimensions of fire-box, I cannot give you exact sizes, but these you can work to if you have the design. I assume from your sketch that the furnace has a flat top. I should advise you to make the lamp of sheet-brass, and on the plan illustrated herewith. In a horizontal fire-box there is more difficulty in obtaining a uniform air supply than in a vertical one, and special means may be required to distribute the flames equally to the tubes. Fig. 1 is a transverse, and Fig. 2 a longitudinal, section of the fire-box, the former being taken on the line 1—2 on the latter. The same letters refer to the same parts in both figures: A is the boiler shell; B, the fire-box; C C, the lamp or burner, in which are four wick tubes (D) extending about three-fourths the length of the fire-box. These holders (D), which are to contain the ordinary woven wick, have inclined upper edges, as shown, in order that the flame may be evenly distributed over the flue tubes. Air



Marine Boiler.

flows in between the wick holders from the front. The ordinary wheel arrangements may be attached for adjusting the wicks. Paraffin is supplied to the burner, C C, from a reservoir (not shown) by a pipe, E, which must of course be fitted with a cock to regulate the supply of oil. The oil should be of a high flashing temperature to obviate accidents. By

means of the cock on the pipe, E, you can adjust the supply to any requirement, from merely keeping the water at boiling point to maintaining the highest evaporation of which the apparatus is capable. In order to supply air to the back part of the burners, and prevent smoke and soot, a cross-pipe, G, is there placed, having perforations or a long slot, H, in it, directed towards the burners as shown. A baffle plate, I I, may be used to deflect some of the flames to the lower tiers of tubes, but this should be made removable until the exact requirements of the furnace are ascertained by trial. If the chimney blast does not draw sufficient air through the pipes, F, which furnish air to the cross-pipe, G, a small fan may be used to assist, or small steam jets may be fitted to the pipes, F, though this is objectionable, as steam thrown into a furnace robs it of heat.—F. C.

Japanning.—SOCRATES.—The reason your articles are tacky may proceed from various causes. You may have put the japan on too thickly, you may not have used the right kind of japan, your work may have been greasy when you put it on, or you may have baked the articles in an oven without ventilation. A great point depends on the oven being well ventilated to allow of the escape of the volatile solvents used in the manufacture of the japan, which are driven off by the heat. For a simple efficient oven, I should advise one made something like a gas cooking oven—square, open at the bottom; pipe running round the bottom with the ordinary pinhole jets, but instead of one outlet of air at the back, as is usual in these ovens, I should have about four 1½ in. or 2 in. holes on each side. With regard to the time to leave the articles in, that depends so much on circumstances, such as thickness of metal, size of work, etc., that I think a few experiments with pieces of tin, etc., using a thermometer and noting results, will give you more information than I could here. I am not aware of any particular method of cleaning the work; provided it is free from spirits of salts, grease, and moisture, that is enough. If in doubt as to the japans you are to use, apply to Messrs. Wilkinson, Heywood, & Clark, japan manufacturers, Caledonian Road, N., where you can get anything you require in that line. Glad to hear that you appreciate the articles on Sheet Metal Work; there are some more in hand that will probably be of still greater use to you.—R. A.

Galvanising Brass Castings.—J. D. (*Strabane*).—From the manner of your inquiries—viz., asking for the "receipt" for tinning nails and galvanising rivets, and the receipt for casting brass keys and "brasen"—by which I presume you mean brazing—it is very evident to me that you have not even an elementary knowledge of the things you inquire about. This being the case, it would be useless to take up space with a lengthy reply such as your queries would involve. I can, however, give you a piece of good advice, which is this: As you are a new reader of WORK, get all the back numbers as soon as you can, and you will there find much that will be valuable to you, and possibly something on the subject you write about.—R. A.

Cycle Parts.—T. S. (*Morpeth*).—The St. George's Cycle Company is a reliable one. I have dealt with them for the last two years in cycle goods, and have always found them prompt in sending parcels, unless they were out of certain things, and waited for them, when two, or even three, weeks might elapse. I should never think of referring readers to any firm unless I had experience of it.—A. S. P.

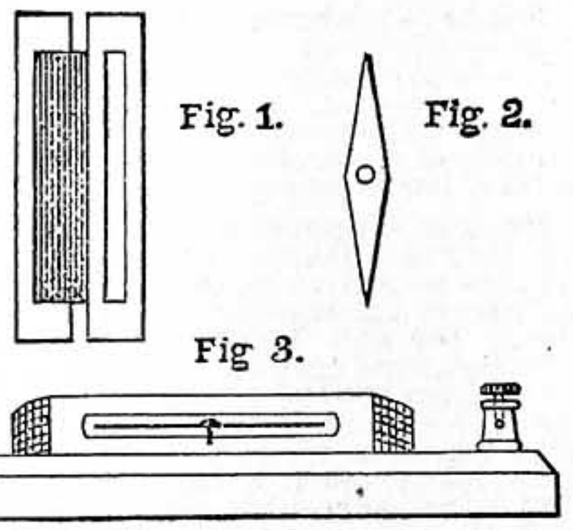
Polish for Bookcase.—T. F. (*Tamworth*).—As a means of keeping it clean and showing up the beauty of the wood, polishing is much preferable to varnish; but as you do not seem conversant with the *modus operandi*, I should strongly advise you to read carefully the articles, "How to French Polish" and "The Rubber in French Polishing," which appeared in Nos. 105 and 108 of WORK; also the hints on polishing constantly appearing in "Shop." Then try your 'prentice hand on something you prize less than the bookcase. You will then get an insight of what polish will do, and become possessed of rubbers that will be of great assistance when you come to the bookcase itself, which, in the meantime, might be kept clean by giving one or two coats of white polish applied with a camel-hair brush. Then, when you feel yourself more proficient, this can be rubbed smooth with fine glass-paper, and then French polished with far more satisfaction to yourself than if you take it for your maiden effort. If desired to be kept light-coloured, use white polish; if a darker or reddish shade, brown polish is used; but owing to the presence of so much carving, etc., I should advise you to use the white polish.—LIFEBOAT.

Bicycle Parts.—A. A. M. (*Lower Clapton*).—A. A. M. will get bicycle parts plated by numerous electro-platers in London. I may mention Brown Brothers, 7, Great Eastern Street, and St. George's Cycle Company, Islington. The latter firm will also supply him with a pneumatic saddle. I am not acquainted with the construction of such a saddle, but I know it would be a ticklish job to make by one not accustomed to such work. To enamel or paint a bicycle with enamel, scrape off all old paint. If it is difficult to remove, coat it well with methylated spirit: this will soften the paint or varnish, when it may be cleaned off, and the surface well rubbed down with sand-paper or emery-cloth. Wipe clean, and procure quick-drying *club black enamel*, 1s. per bottle, with brush. Float the enamel on quickly and evenly, as it dries very fast, taking care not to go over the same part twice. When dry, apply another coat, and you will have a good surface.—A. S. P.

Piccolo Banjo.—G. H. (*London, S.E.*).—The size of piccolo banjo that I generally make, and which gives the best results, is one with a 7 in. hoop and 8½ in. finger-board—that is, 8⅛ in. from nut to end of finger-board where it joins the hoop. This size you can tune to concert pitch one octave higher than a full-sized banjo. You could make the hoop smaller, adding to length of finger-board what you take off hoop. You will get a more powerful tone by using the sized hoop I have given. If you want to swing it about when playing, fix a piece of string or a strap on end, and long enough to slip over the wrist. Number of brackets, twelve or sixteen; width at nut, 1⅛ in.; ditto at end of finger-board, 1¾ in. The sizes given you will find comfortable to play on. If you have thin finger-tips, you might make it a shade narrower; better rather wide than having the strings too close, and not being able to stop one string without touching the next one to it. My own "Jo" is 1 in. at nut, and a little longer finger-board. If you make it longer than the size I have given, you will find the strings will not stand when tuned up to concert pitch. Size of hoop for this banjo, 9 in., and 16 in. finger-board; or 8 in. hoop, 17 in. finger-board; widths at nut and end against hoop same as piccolo; number of brackets, eighteen or twenty. You could put on more brackets, but, providing those you use are well made, you will only be adding to the weight of them without any additional advantage being derived from putting more on than the number I have given.—J. G. W.

IV.—QUESTION ANSWERED BY A CORRESPONDENT.

Galvanometer.—M. (*Bishop Auckland*) writes, in reply to GALVANIC (see page 206, No. 117):—"Make a bobbin of cardboard, by gluing a strip of card on a piece of wood 2½ in. wide and ⅜ in. thick. Make the strip 1 in. wide, and fix two ends or flanges projecting ¼ in. all round. These can be fixed by gluing a strip of paper round the inside. (See Fig. 1, which shows bobbin ready for wire.) Wind three coils of No. 36 S.C. wire on the bobbin, keeping the wood in while winding, and leaving two ends 6 in. long. Also wind one coil of No. 22 S.C. wire, leaving 6 in. ends. Make a base-board 6 in. square, and fix in the centre a needle projecting upwards ½ in., and pass this through the wire in the centre, and fix the bobbin to the base-board by a small wooden block at each end. Fix three small binding screws at one side of base-board, and fix a thick and thin wire to one, and a thin wire to one of the remaining screws, and a thick wire to the other. Make the needle 2¾ in. long, as shown in Fig. 2, from a piece of steel spring, which must be heated blood-red and allowed to cool. Cut and file to shape, and drill a hole in



Galvanometer. Fig. 1.—Cardboard Bottom. Fig. 2.—Needle. Fig. 3.—Section of Galvanometer.

centre, and rivet a piece of brass in it, and drill nearly through the brass a fine conical hole. Then harden the needle by heating blood-red and cooling in cold water. Lay it across the poles of a large permanent magnet for twenty minutes to magnetise it, or insert in a coil of wire and send a quantity of jerky charges through it from a strong battery. It is now to be fixed on the needle point inside the bobbin. If it does not hang level, put a little sealing-wax on the light end to balance it. In use, the bobbin must be set N. and S.; and by using the fine wire you can test for intensity, and by the thick wire for quantity. Fig. 3 is a section of bobbin and needle. You can make the bobbin longer than 1 in. if you want to put a larger quantity of wire on. You will find this a very useful instrument; and if there is anything you do not understand, if you write again I will give you further particulars."

V.—BRIEF ACKNOWLEDGMENTS.

Questions have been received from the following correspondents, and answers only await space in SHOP, upon which there is great pressure:—SOMERSET; A WEEKLY SUBSCRIBER; W. N. (*Lyndhurst*); R. H. (*Notting Hill*); F. H. B. (*Manchester*); C. G. (*Putney*); ELECTRICAL COMPANY; D. H. (*Glasgow*); H. C. (*Lancaster*); E. C. W. (*London, E.C.*); PLUCK DEVON; F. J. P. (*West Bromwich*); H. H. (*No Address*); E. G. P. (*Kingsland*); J. E. B. (*Birmingham*); G. R. (*New Seaton*); T. W. V. (*Leicester*); J. D. (*Hull*); BOWTON LAD; D. S. (*Glasgow*); J. T. H. (*Bacup*); R. W. (*Barnsley*); R. W. (*Blaina*); E. W. G. (*No Address*); J. A. (*Wandsworth*); AMATEUR; C. D. (*Corfe*); SHOTTS; W. C. (*Shrewsbury*); L. B. (*Wells*); W. B. (*Manchester*); K. (*Keighley*); HARDWORK; R. E. D. (*London, E.C.*); E. W. (*London, N.*); H. B. S. (*Liverpool*); R. P. (*Islington, N.*).

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